United States Environmental Protection Agency

Office of Emergency and Remedial Response

EPA/ROD/R03-92/149
June 1992

EPA

Superfund Record of Decision:

Butz Landfill, PA

NOTICE

The appendices listed in the index that are not found in this document have been removed at the request of the issuing agency. They contain material which supplement, but adds no further applicable information to the content of the document. All supplemental material is, however, contained in the administrative record for this site.

50272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO. EPA/ROD/R03-92/149	2.	3. Recipient's Accession No.

4. Title and Subtitle
SUPERFUND RECORD OF DECISION
Butz Landfill, PA
Second Remedial Action - Final

5. Report Date
06/30/92

6.

7. Author(s)

8. Performing Organization Rept. No.

9. Performing Orgainization Name and Address

10. Project/Task/Work Unit No.

11. Contract(C) or Grant(G) No.
(C)
(G)

12. Sponsoring Organization Name and Address
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

13. Type of Report & Period Covered
800/000

14.

15. Supplementary Notes
PB93-963919

16. Abstract (Limit: 200 words)

The Butz Landfill is an inactive landfill in Jackson Township, Monroe County, Pennsylvania. The 1.5-square-mile site extends into Pocono Township and includes the known extent of contamination and the 8.5-acre landfill. The sole source aquifer underlying the site supplies drinking water for approximately 3,300 people who live within 3 miles of the site and an additional 3,000 people during summer tourist seasons. In 1963, the property was purchased by the Butz family for landfill development. Beginning in 1965, municipal waste, sewage sludge/liquids, and possibly some industrial wastes were accepted at the landfill. During the years that the landfill operated, the waste was disposed of without a state permit. In 1971, onsite investigations revealed well water contamination and the presence of leachate seeps. By 1973, the state ordered the landfill closed and required that corrective measures be taken, including the development of a surface water management plan, ground water monitoring, and placement of a cover over the landfill. In 1986, additional onsite investigations revealed high TCE levels in domestic wells to the south of the landfill, which prompted a request to EPA that the site be considered for emergency action. The

(See Attached Page)

17. Document Analysis a. Descriptors
Record of Decision - Butz Landfill, PA
Second Remedial Action - Final
Contaminated Medium: gw
Key Contaminants: VOCs (benzene, PCE, TCE)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 76
	20. Security Class (This Page) None	22. Price

(See ANSI-Z39.18) See Instructions on Reverse OPTIONAL FORM 272 (4-77) (Formerly NTIS-35) Department of Commerce

Abstract (Continued)

same year, the state and EPA initiated emergency response activities, including additional sampling, installing water coolers, and supplying bottled water or carbon filters to homes with contaminated well water. A 1990 ROD addressed the first of two operable units, establishing an alternate water supply. This ROD addresses OU2, designed to prevent human exposure to contaminated ground water. The primary contaminants of concern affecting the ground water are VOCs, including benzene, PCE, and TCE.

The selected remedial action for this site includes installing ground water extraction wells immediately downgradient from the landfill in the area of suspected ground water and DNAPLs contamination; extracting and transporting ground water to an appropriate treatment facility and treating the extracted water using either chemical precipitation, followed by air stripping with vapor phase carbon units to control emissions or granular activated carbon, as determined during the RD phase; discharging the treated ground water onsite to surface water; and disposing of residuals produced during the treatment process offsite. The estimated present worth cost for this remedial action ranges from $11,012,000 to $14,495,000, (depending on the final treatment selected during the RD), which includes an annual O&M cost ranging from $561,000 to $861,000 for up to 10 years.

PERFORMANCE STANDARDS OR GOALS:

Clean-up goals for ground water are based on SDWA MCLs and state standards designed to achieve background levels for all of the VOCs in the ground water, thereby restoring the ground water to its beneficial use as a drinking water source. Background concentrations will be determined by EPA based on contaminant concentrations in upgradient monitoring wells.

(1)

RECORD OF DECISION
BUTZ LANDFILL SITE
OPERABLE UNIT TWO

DECLARATION

SITE NAME AND LOCATION

Butz Landfill Superfund Site
Pocono and Jackson Townships, Monroe County, Pennsylvania

STATEMENT OF BASIS AND PURPOSE

This Record of Decision (ROD) presents the selected remedial action for the Second Operable Unit at the Butz Landfill Site, Pocono and Jackson Townships, Monroe County, Pennsylvania. The remedial action was developed in accordance with the statutory requirements of the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986 (CERCLA), 42 U.S.C. §§ 9601 et. seq., and is consistent with the National Contingency Plan (NCP), 40 CFR Part 300. This remedy selection decision is based on the Administrative Record for this site (index attached).

The Commonwealth of Pennsylvania concurs with this remedial action (copy of the concurrence letter is attached).

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action(s) selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

The selected remedial alternative for this Operable Unit will mitigate and/or prevent human exposure to contaminated ground water. Implementation of this remedial alternative is intended to clean contaminated ground water to background concentrations. No remedial actions are necessary for surface water, sediments, or for the landfill proper.

The selected remedy includes the following major components:

1. The installation of ground water extraction wells immediately downgradient of the area of suspected

DNAPLs and along the downgradient perimeter of the area of contaminated ground water.

2. The construction of piping necessary to transport the extracted ground water to an appropriate treatment facility.

3. The construction of treatment systems and the treatment of the extracted ground water to discharge quality.

4. The disposal of the treated ground water by discharge to local surface water streams.

5. The offsite disposal of any residuals produced during the treatment process.

6. The construction of access roads, electric power lines, etc. as necessary.

7. The operation and maintenance of the ground water extraction and treatment system for up to 10 years.

STATUTORY DETERMINATIONS

The remedial action specified in this ROD was determined to be necessary to clean up the contaminated ground water. There is evidence of the possible existence of dense non-aqueous phase liquids (DNAPLs) immediately downgradient from the landfill. The recently recognized effects of DNAPLs, which, if present, provide a continuing source of contamination, may extend the time necessary for restoration or even preclude the restoration of the ground water to applicable or relevant and appropriate requirements (ARARs). If, at a later time, EPA concludes that fundamental changes are needed to this selected remedy, EPA will amend this Record of Decision or may write a new Record of Decision to address the ground water contamination.

The remedial action selected for this Operable Unit is protective of human health and the environment, attains federal and state requirements that are applicable or relevant and appropriate to the remedial action, and is cost-effective. The remedial action selected for this second Operable Unit is part of a total remedial action that has been selected for the Site. The remedy selected in this ROD employs treatment that permanently and significantly reduces the toxicity, mobility, or volume of hazardous substances as its principal element and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

Because this remedy will result in hazardous substances remaining onsite above levels which would allow the unrestricted use of the ground water, a review under Section 121(c) of CERCLA, 42 U.S.C § 9621(c) will be conducted within five years of the start-up of this action, and every five years thereafter, to ensure that the remedy continues to provide adequate protection of public health, welfare and the environment.

for Edwin B. Erickson
Regional Administrator
Region III

6/30/92
Date

REMEDIAL ALTERNATIVE RECORD OF DECISION SUMMARY
BUTZ LANDFILL SITE

1. SITE LOCATION AND DESCRIPTION

The Butz Landfill Site ("Site") is located south of Camelback Mountain, along Township Road 601, in Jackson Township, Monroe County, Pennsylvania. The entire site, which includes the known extent of trichloroethylene-contaminated ground water, covers approximately 1.5 square miles and extends into Pocono Township. The closest town is Reeders, approximately one mile south of the Site (Figure 1). A population of approximately 3,300 people live within three miles of the Site. Because of the presence of various resorts and summer homes in the area, the population approximately doubles during the tourist seasons of winter and summer. The generally low number of people per square mile is associated with the two primary uses of land in the area: recreational activities and farming. The primary crops are corn, hay, wheat and potatoes.

Surface water drainage in the area is mainly to the southeast, following the topographic gradient. The nearest sink for surface water runoff is an intermittent stream located approximately 2,700 feet southeast of a landfill on the Site (Figure 2). This stream is a tributary to Reeders Run Creek. Poorly drained areas and annual springs also exist southeast of the site.

Geologically, the Site falls on the border of the Appalachian Plateau and the Valley and Ridge Physiographic Province. Locally, Camelback Mountain forms part of the Pocono Plateau escarpment, with the Butz Landfill ("Landfill") situated at the foot of the southeast slope of the escarpment. The Site lies on the Long Run Member of the late Devonian Age Catskill Formation. The Long Run Member consists of alternating gray sandstone and red siltstone and shale. Fracturing in the bedrock is controlled by the thickness and brittleness of the beds. The Catskill Formation dips gently to the northwest in the Pocono Plateau but becomes more complexly folded in the Valley and Ridge Province located to the southeast.

Overlying the bedrock in the area are reddish glacial tills deposited during the Pleistocene Epoch. Till deposits consist of a sorted and non-sorted mixture of clay, silt, sand, pebbles, cobbles, and some boulders, and ranges from 5 to over 25 feet in thickness. Developed upon the glacial till in the immediate vicinity of the Site are the Lackawanna-Wellsboro-Oquaga Series Soils. These soils are very stony, moderately deep, well drained soils. The topographic gradient in the area of the Site averages 5%, but exceeds 15% over some areas of the Site.

Hydrogeologically, there are two aquifers in the vicinity of the Site. The shallow water table aquifer (overburden aquifer) is located above the bedrock surface, and is the saturated portion of the glacial till. The depth to the ground water is greater than 14 feet at the site but is shallower southeast of the Landfill where the water table probably discharges to the intermittent stream. EPA wells screened in the water table aquifer have water levels ranging between 2 to 19 feet below grade. The ground-water flow direction in the water table aquifer is apparently to the southeast similar to that of surface water drainage. Well yields from this aquifer are generally low.

The other major aquifer in the area is the bedrock aquifer occurring in the Long Run Member of the Catskill Formation. Well yields are higher in this aquifer than the water table aquifer and commonly range between 15-40 gallons per minute (gpm), but may exceed 75 gpm.

The ground-water flow direction in this aquifer is to the east-northeast (Figure 3). This suggests that ground-water flow may be controlled both by stratigraphy and geologic structure.

Ground water flow is confined to the primary and secondary porosity of the bedrock. The secondary porosity is composed of open fractures and joints and forms the more permeable pathway for ground water flow. The degree of fracture and joint development is controlled by the thickness and brittleness of the sandstone, siltstone, and shale units that make up the Long Run Member. Secondary porosity and permeability is, therefore, more developed in the thinner bedded siltstones and sandstones than in the more malleable shales. The siltstone and sandstone units also contain the most primary porosity or intergranular pore space. In this manner most ground water flow is confined by the shales within the porous siltsone and sandstone units. The bedrock aquifer at the Site is in direct contact with and recharged by the overburden aquifer.

The water supply for the area around the Site is provided almost exclusively from ground-water wells which are primarily privately owned. Most ground-water users, including private homeowners, extract ground water from the bedrock aquifer.

A community water supply system is used by Tannersville, located more than three miles east of the site. Water quality in the area is generally good with low levels of dissolved solids and hardness. The primary recharge zone for local ground water is probably the Camelback Mountain area to the northwest of the Site.

2. SITE HISTORY

The property on which the Landfill is located was acquired by Russell and Luella Butz and Ernest and Emma Butz in March 1963, and landfilling operations began as early as 1965. Although the

specific quantities of waste received are unknown, it is known that the 8.5 acre Landfill, which is located near the north-west limit of the Site, accepted municipal waste, sewage sludge/liquids, and possibly some industrial wastes. An operating permit application was submitted to the State of Pennsylvania for the Landfill in 1970, but the permit was subsequently denied due to insufficient technical information about the Landfill site. Waste disposal apparently continued at the site without a permit. The first local citizen complaints about the Landfill are documented as early 1971, and the Pennsylvania Department of Environmental Resources (PADER) made the first site inspections in early 1971. Water well pollution and leachate seeps were discovered at that time. In early 1973, PADER ordered the Landfill closed due to improper operation, and required development of a surface water management plan, ground-water monitoring, and a landfill cover. Waste disposal apparently ceased at the site in late 1973. Ground-water monitoring of local wells was performed until 1979.
Field examination of the Landfill and surrounding areas was again initiated by PADER in 1984. Additional soil, water, and groundwater samples were collected in March, April, and June of 1986. The results indicated high levels of trichloroethene (TCE) in domestic wells to the south of the Landfill which prompted a request from PADER to EPA Region III that the Site be considered for emergency action.

During July 1986, PADER and EPA initiated area-wide response activities including additional site inspections, public information meetings, residential well sampling, and the installation of water coolers and bottled water supplies to homes with contaminated well water. Bottled water was provided to 28 locations, and carbon filtration systems were installed at 22 residences. In addition, 17 groundwater monitoring wells were drilled for further tests and sampling.

In August 1986, the EPA Emergency Response Branch, (ERB) which is known now as the Emergency Response Team (ERT), provided assistance in determining the scope and nature of the contamination. ERB performed magnetometer and soil gas surveys in the area of North Road and surveyed the well locations for the hydrogeological investigation which continued throughout the fall, winter, and spring months. A hydro-geological report was subsequently prepared. The report, dated May 1987, strongly implicated Butz Landfill as the source of contamination. In April 1987, EPA completed a preliminary engineering study and cost estimate for the provision of alternate water supply systems to serve the area of contaminated groundwater wells.

The EPA study concluded that drilling new wells at an elevation protected against groundwater contamination from the Landfill, and constructing a storage tank with a closed-end distribution system was the most effective option complying with good engineering principles. In May 1988, an engineering firm was retained by EPA to provide design engineering services for the water systems, and in March 1989 three new wells were drilled as recommended by the preliminary engineering study. The design work for the water distribution system was substantially completed in January 1990.

In March 1990, the waterline project was transferred from the EPA Region III Emergency Removal Program to the Remedial Program in order to provide funding for the project. In August 1990, EPA completed an Engineering Evaluation and Cost Analysis (EE/CA). A Record of Decision (ROD) calling for the construction of the waterline was signed on September 28, 1990. Construction activities relative to the waterline began in June 1992.

In November 1991, EPA finalized a Remedial Investigation and Feasibility Study (RI/FS) Report. The RI/FS was conducted to determine the types, degrees and extent of Site-related contamination; to estimate risks to public health and the environment as result of the contamination; and to establish a set of possible alternatives for remediation of the Site.

Currently, EPA continues to provide bottled water and carbon filtration systems maintenance to residents of the affected area in addition to regular quarterly sampling.

3. COMMUNITY PARTICIPATION

The Administrative Record File and the Proposed Remedial Action Plan for the Butz Landfill Site were placed in a public information repository located near the Site at the Pocono Township Public Library, Tannersville, Pennsylvania and were available for public review on April 22, 1992. Site related documents were also maintained at the Region III office. The availability of these documents and a brief description of EPA's Proposed Remedial Action Plan was published in the Pocono Record, a local newspaper, on April 22, 1992. In both the Proposed Remedial Action Plan and the newspaper notification, the public was advised of the opportunity for a public meeting. A public comment period was held from April 22, 1992 to May 22, 1992. A Public Meeting was held on May 7, 1992 at the Jackson Township Municipal Building, Reeders, Pennsylvania. A response to the comments received during this period is included in the Responsiveness Summary which is part of this Record of Decision. A transcript of the Public Meeting is included in the Administrative Record for the Site. These Community Participation procedures were conducted in compliance with Section 113(k) and Section 117 of CERCLA.

4. SCOPE AND ROLE OF THE OPERABLE UNIT

EPA has organized the response work into two operable units for the Site. The first operable unit ROD was signed September 28, 1990 and authorized the construction of a drinking water pipeline. Construction activities relative to the pipeline began in June 1992.

The second operable unit authorized by this ROD addresses the Landfill itself, surface waters, sediments and ground water and the remedies, in addition to the waterline, that EPA has selected to reduce risks to public health, welfare and the environment resultant from exposures to Site-related hazardous substances.

5. SUMMARY OF SITE CHARACTERISTICS

As described above, the Site is on the Long Run Member of the late Devonian Age Catskill Formation. The Long Run Member consists of alternating gray sandstone and red siltstone and shale comprising a fractured bedrock. Fracturing within these units is controlled by bed thickness and brittleness. Overlying the bedrock are reddish glacial tills consisting of a sorted and non-sorted mixture of clay, silt, sand, pebbles, cobbles, and some boulders.

Hydrogeologically, there are two aquifers in the vicinity of the Site: The shallow water table (overburden) aquifer, and the bedrock aquifer. The water supply for the area around the Site appears to be provided exclusively from ground water wells which are primarily privately owned. Most ground water users extract drinking water from the bedrock aquifer.

Extensive environmental investigation began at the Site in early 1986 by PADER and USEPA. These early environmental investigations included ground-water sampling from over 50 domestic water supply wells; surface water sampling from nearby steams, seeps, and springs; sediment sampling from streams and seeps; a soil vapor survey of a portion of the Landfill area; and the installation, pump testing, and sampling of seventeen monitoring wells in the vicinity of the Landfill.

The results of the ground-water sampling of the domestic and monitoring wells indicate widespread volatile organic compound contamination, primarily trichloroethene (TCE), in the vicinity of the Landfill and strongly point to the Landfill as having been the source of the contamination. Figures 4 and 5 show the extent of the TCE plume in the bedrock aquifer and the overburden aquifer, respectively.

As a result of sampling for volatile organic compounds conducted in 1986 by EPA, at least 22 drinking water wells were found to be contaminated. The contaminants in these wells include: vinyl chloride (up to 11 parts per billion (ppb)); tetrachlorethane (up to 1.5 ppb); trichloroethene (up to 7,000 ppb); trans-1,2 dichloroethene (up to 260 ppb); and 1,1-dichloroethene (up to 8ppb).

Periodic ground-water sampling of up to 50 residential wells located near the Landfill has been performed since 1986 (Table 1). (See Figure 6 for location of residences listed in Table 1). The residential wells located immediately to the southeast of the Landfill show the highest level of contamination - in the range of 4000 to 7000 micrograms per liter (ug/l). The concentration of TCE in these wells has remained fairly constant over the last five years. Other residential wells located both to the east and southwest of the Landfill show much lower concentrations of TCE. TCE concentrations in the ground water intercepted by these wells have varied, depending on specific well location, over the last five years.

Ground-water sampling of the 17 monitoring wells installed by EPA was performed once in 1987 (Table 2). Sixteen of the seventeen wells were sampled for volatile organic compounds. Well R1S was sampled for all Priority Pollutant Compounds. Again, volatile organic compounds were the predominant type of contaminant found; trace levels of base neutral compounds were also detected. A high of 236 ug/l of TCE was found in the overburden aquifer. A high of 15,700 ug/l of TCE was found in the bedrock aquifer in the vicinity of the Landfill.

5.1 OVERVIEW OF RI/FS ACTIVITIES

As stated in the paragraph above, in 1987 EPA installed and sampled 17 monitoring wells to assess ground water contamination geologic and hydrogeologic conditions in the vicinity of the Site. In 1990, for the purposes of the RI/FS, the original 17 monitoring wells were sampled twice. EPA also installed and sampled another monitoring well in the glacial till southeast of the Landfill (well #T5). In addition , three business wells and two home wells located east of the Landfill and beyond the previously established limits of the known ground water contamination were sampled (refer to Figure 4). The ground water investigation included a review of the numerous samplings of ground water from home wells in the vicinity, and also included physical testing which was conducted to assist in determining ground water flow characteristics.

The RI/FS investigation included the taking of 16 surface water samples, 16 sediment samples, twelve samples for wetland determination, and sampling for vertebrates and macroinvertebrates at 9 surface water locations. Twenty-eight backhoe pits and five soil borings were made directly into the Landfill and resulted in the taking of bottom soil samples from 17 of the pits and 4 of the borings. Thirteen surface soil samples were obtained, primarily from the Landfill surface. The Landfill itself and the surrounding area were characterized for benthic, riparian and terrestrial ecology and risks to human health and environmental receptors due to Site-related hazardous substances were determined. The RI/FS information gathering process included the review of historic data from previous EPA and PA DER samplings and investigations.

5.2 THE BUTZ LANDFILL

The Landfill occupies approximately 8.5 acres on two adjacent properties (Figure 7). For the purposes of the Remedial Investigation, thirteen surface soil samples were collected between December 3 and 7, 1990 (Figure 8). Samples SS-01 and SS-02 were collected in a field north of the Landfill and were intended as background samples. No organic compounds were detected at SS-01. Acetone, fluoranthene, and pyrene were detected at SS-02 in concentrations of 140, 180 and 150 micrograms per kilogram (ug/kg), respectively (Table 3). Obviously, this contamination of a background sample could not have been anticipated. The contamination in the sample was not Site-related.

The only other locations where organic compounds were detected were SS-07 and SS-08. SS-07 contained Aroclor 1260 at a concentration of 270 (J) ug/kg and bis (2-ethylhexyl) phthalate at a concentration of 110 ug/kg. (Note: The "J" qualifier means that the analyte is present, but the reported value is estimated.) SS-08 contained butylbenzylphthalate at a concentration of 170 ug/kg and bis(2-ethylhexyl) phthalate at a concentration of 120 ug/kg. Of the inorganic contaminants, beryllium was found in a concentration of 0.21 mg/kg at location SS-04 while zinc was found at all locations in concentrations ranging from 51.6 to 341 mg/kg. No evidence of leachate seeps was observed on the Landfill or in the vicinity of the Landfill.

Twenty-eight test pits were excavated and 5 test borings were drilled through the Landfill (Figure 9). The fill materials ranged from 0 up to 19 feet thick (Figure 10). Weathered rock was encountered at the bottom of Borings 01, 02, 03, and 05. No soil was recovered from the bottom of Boring 04. The greatest thickness of fill is on the central eastern portion of the property.

All samples collected from the test pits and test borings were collected from soil that was found immediately beneath the fill materials. No soil for sampling and analysis purposes was found at the bottoms of eleven of the test pits.

Numerous organic compounds were found in the soil samples from the borings and test pits. Trichloroethene was found in the soil in Boring 01 (Table 5) in a concentration of 23 ug/kg. This was the only soil sample out of 21 subsurface soil samples analyzed that contained any TCE. Numerous semi-volatile organic compounds, including polycyclic aromatic hydrocarbons (PAHs) were found in the soil from Boring 03 ranging from 88 to 900 ug/kg. No organic compounds were detected in Borings 02 and 05.

No organic compounds were detected in soil samples from test pits 01, 02, 05, 19A, 07, 08, 20, and 23. The volatile organic compounds ethylbenzene and total xylenes were present in 6 test pits ranging from 3 to 90 (J) and 3 to 2,000 ug/kg, respectively (Table 4). The greatest number of organic compounds was detected in TP-19, which contained sewage sludge material. Soil from this location contained elevated levels of the volatile organic compounds chlorobenzene (22,000 ug/kg) and toluene (8,800 ug/kg), the polychlorinated biphenyl aroclor 1254 (2,800 [J] ug/kg), 3 different pesticides totalling 1,173 ug/kg, and 10 semi-volatile organic compounds totalling 490,600 ug/kg (all flagged with J qualifiers).

Of the inorganic contaminants, lead was present above background in 9 test pits at levels ranging from 6.1 to 597 ug/kg. Beryllium was also elevated in 4 test pits and 2 test borings at levels ranging from 0.2 to 0.4 ug/kg.

Most of the fill materials can be described as typical municipal garbage. A common type of fill observed was textile material in long thin shreds. Of note, several test pits were excavated in an area defined by magnetic anomalies identified in the previous USEPA investigation (ERB/EERU, 1987). These areas were investigated for the possible presence of buried drums. No drums were found in the test pits (TP-12 and TP-18), however, abundant car parts and other steel debris were encountered. A small (35 gallon) crushed drum was found in TP-11 and 2 open-topped crushed drums were found in TP-22 but these were isolated occurrences. In both of these instances, the drums were empty.

Also of note, several test pits were excavated in areas where sewage sludges had reportedly been placed in pits and trenches. These pits and trenches were identified in historical aerial photography (EPIC, 1989). Sewage sludges were found in several test pits including TP-19, TP-20, TP-24, and TP-30. These test pits are located in the southern portion of the Butz property. Sludge materials were generally found in 1 to 2 foot thick seams at shallow depths (less than 8 feet). In several cases, the sludge was encountered immediately overlying bedrock. In those cases where no soil was present, no sample was collected.

No ground water or leachate was encountered in any of the test pits or test borings.

5.3 GROUND WATER

As mentioned previously, 17 existing monitoring wells, 1 newly installed monitoring well, and 5 residential wells were sampled during the RI/FS. The 17 wells were initially sampled for the purposes of the RI/FS during the last week of October, 1990. These wells were sampled again in December, 1990, along with the new monitoring well (T5), two residential wells which had not previously been sampled and three business wells which also had not been sampled previously.

The monitoring wells were designated in the following manner: "T" designates monitoring wells screened in the glacial till with depths of the wells ranging from 12 to 28 feet; and "R" designation denote monitoring wells open in bedrock with depths ranging from 100 to 250 feet (Figure 11).

The primary group of chemicals present in the ground water are volatile organic compounds, especially trichloroethene, 1,2-dichloroethene (total), and vinyl chloride.

In the first sampling round, TCE was present in every monitoring well except R5, which is located to the west, and considered to be upgradient of the Landfill (Table 6). Concentrations ranged from 9 ug/l in well T1.1A to 8400 (J) ug/l in well R1D. Concentrations of TCE, 1,2-dichloroethene (total), and vinyl chloride were highest in wells located in the southeastern corner of the Landfill (R1D, R1S, T1A) and in well R2, which is located southeast of the Landfill.

In comparing results obtained in 1987 (ERB/EERU, 1987) (see Table 2) with the October, 1990 results, the concentration of TCE has increased in well R1D from 5050 ug/l to 8400 ug/l. Well R2, which previously had the highest concentration of TCE in 1987 at approximately 15,700 ug/l, showed a dramatic decrease to 770 ug/l.

Other than the VOCs, very few organic compounds were found in the ground water. No pesticides or PCBs were detected above quantitation limits. Of the inorganic contaminants, barium and manganese were found above background. Manganese ranged from a minimum of 27.9 ug/l in well R6 to a maximum concentration of 19,000 ug/l in well T2. Barium ranged from a minimum of 57.5 ug/l in well R3S to a maximum to 436 ug/l in well T2.

In the second round of ground-water sampling, TCE, 1,2-dichloroethene, and vinyl chloride were again the compounds most frequently detected (Table 7). In general, the concentrations of these compounds were less than those measured in October, 1990 in the wells located nearest the Landfill, while concentrations remained nearly the same for wells located farther from the Landfill. In October, TCE was present above quantitation limits in all wells except R5. In December, TCE was not detected above quantitation in wells TIB, R4, R5, R6, and the new well, T5. The only organic compound present in well T5 was 1,2-dichloroethene, in a concentration of 14 ug/l.

Increases in TCE and 1,2-dichloroethene were noted in well T1.1B, located near the Landfill and well R3S, located to the southwest of the Landfill. In well T1.1B, the concentrations increased approximately 15 times. In well R3S, the concentrations of TCE and 1,2-dichloroethene doubled between October and December. In well R2, the TCE concentration increased from 770 to 950 ug/l, but the concentration of 1,2-dichloroethene decreased from 950 to 730 ug/l.

As in the first round of sampling, very few other organic compounds were present above quantitation limits. Again, no pesticides or PCBs were present in the ground water. Manganese and barium were present as inorganic contaminants.

A comparison of the total concentration of volatile organic compounds detected in the ground water in 1987 versus 1990 (average of October and December results) is depicted in Figure 12. Table 8 shows TCE concentrations in the EPA-installed monitoring wells for the January 1987, October 1990, and December 1990 sampling events.

Ground water sampling was also performed during a pump test of well R2. During the pump test, 2 samples were collected of the influent water to the air stripper used to treat the discharge water. One sample was collected 15 minutes into the pump test. The concentration of TCE at the time was 110,000 ug/l compared to concentrations of less than 1,000 ug/l measured in two separate ground water sampling events on this well. After 19 1/2 hours, the concentration of TCE had reduced to 7 ug/l (Table 9).

There is, as noted in Sections 4.7 and 5.0 of the RI/FS, evidence that TCE exists in the bedrock as a dense non-aqueous phase liquid (DNAPL) in the vicinity of the Butz Landfill. While performing the pump test noted previously, a water sample was collected which had TCE in a concentration of 110,000 ug/l (110 mg/l), or 10% of TCE's solubility in water.
TCE has a density of 1.46 grams per cubic centimeter (g/cc) and a solubility in water of 1100 milligrams per liter (mg/l). Since the TCE is more dense than water, the non-dissolved portion will sink by gravity through the ground water and bedrock until it encounters an impermeable barrier. At the barrier, the TCE will accumulate as a liquid, i.e., the DNAPL. There, some portion of the TCE will dissolve into the ground water. The soluble phase

of DNAPLs are rarely found in excess of 10% of their solubility.

The sampling results also indicate a continuing source of TCE in the ground water in the vicinity of the Landfill even though EPA's research has not found any evidence of TCE dumping at the Landfill and the RI/FS activities found no indication that the Landfill is a current source of the TCE contamination in the ground water. This is further evidence to indicate that the ground water contamination due to TCE possibly results from TCE which exists as DNAPLs.

Five residential wells were sampled during the 1990 RI/FS, all located to the east of the Landfill. The only organic compound detected was naphthalene at the Thirsty Camel Restaurant, in a concentration of 0.7 (J) ug/l (See Figure 4 for the well locations). This residence is located approximately 1000 feet northeast of the Landfill.

With respect to the inorganic contaminants in the residential wells, aluminum was present in the ground water at the Mobil Station in a concentration of 79.30 ug/l; arsenic was present at the Riday residence in a concentration of 2.40 ug/l; barium was present in all wells tested, with the exception of the Mobil Station, in concentrations ranging from 2.10 to 69.50; and manganese was present at the Riday and the Shaffer residences. The level of aluminum measured at the Mobil Station exceeded the maximum level of aluminum measured in any of the monitoring wells. The maximum concentrations of the other inorganic contaminants detected in the residential wells were within ranges measured in the monitoring wells.

The results of the ground-water sampling of the domestic and monitoring wells indicate widespread volatile organic compound contamination (primarily TCE). As noted previously, periodic ground-water sampling of up to 50 residential wells located near the Landfill (Figure 6) has been performed since March 1986. The residential wells located to the southeast of the Landfill show the highest levels of TCE contamination, with concentrations in the range of 4000 to 7000 ug/l (Table 1), and show the greatest fluctuations in TCE concentrations over time (Figure 13, upper block). Other residential wells located both to the east and southwest of the Butz Landfill show much lower concentrations of TCE, with concentrations in the range of 30-300 ug/l, and also show less fluctuation in TCE levels over time (lower block, Figure 13). The distribution of TCE in the residential wells, based on the most current data available for each well, is depicted in Figure 4.

5.4 SURFACE WATER AND SEDIMENTS

The sampling of surface water and sediment in adjacent streams, seeps, and potential wetland areas was performed to determine whether these areas had been impacted by contaminants from the Landfill and whether the level of contaminants, if any, posed a risk to either human health or the environment.

Surface water and sediment samples were collected at 14 locations from streams surrounding the Landfill (Figure 14). A number of physical and chemical parameters were measured in the surface water and sediment. Stations 15 and 16 were located on a stream west of the Landfill and were intended as background samples. In general, the nature of the physical parameters, and the absence of organic chemicals, indicate good water quality in the streams surrounding the site.

All surface water samples were analyzed for Target Compound List organic compounds and Target Analyte List inorganic elements. In general, very few organic compounds were detected in the surface water (Table 10). Many of the compounds that were detected are qualified with a "J" and are found in low concentrations. Trichloroethene (TCE) was detected in 6 of the 14 surface water sampling stations (SW-01, SW-02, SW-03, SW-04, SW-10, and SW-13). All of these stations, except SW-01, are located to the south or southeast of the Landfill. Local drainage is controlled by the topographic slope, which is to the southeast in the vicinity of the Landfill.

Surface water sampling station SW-04 is located upgradient of the Landfill. No volatile organic compounds were detected at SW-04. Mercury was the only inorganic contaminant found at SW-04, in a concentration of 0.25 ug/l.

The next station downstream from SW-04 is Station SW-13. SW-13 lies southeast of the Landfill. At this station, TCE, vinyl chloride, chlorobenzene, and total 1,2-dichlorobenzene were detected in concentrations of 1 (J), 2 (J), 2 (J), and 10 ug/l, respectively. These compounds have been found in the ground water and probably reflect discharge of shallow ground water to the surface at this location. Elevated levels of arsenic, barium, iron, and manganese were also found in the surface water at this station in concentrations of 2.4, 104, 749, and 2010 ug/l, respectively.

Downstream from Station 13, are Stations 02, 03, 09, and 01. TCE was not detected at Station 09, but was detected at Stations 02, 03, and 01 in concentrations of 10, 2 (J), and 2 (J) ug/l, respectively. Of the inorganic contaminants, iron and manganese were detected above background levels at Station 02. Mercury was detected above background at Station 03. Aluminum, iron, and mercury were detected above background at Station 09. Barium and mercury were detected above background levels at Station 01.

TCE was present at Station 10, which is a seep located south of the Landfill, in a concentration of 1 (J) ug/l. No inorganic contaminants were found at this station.

No organic contaminants were detected at stations 05, 06, or 07. However, aluminum and iron were present above background at Station 05, aluminum, barium, iron, and mercury were present above background at Station 06, and iron was above background at Station 07.

Two semi-volatile organic compounds (benzoic acid and Di-n-butylphthalate) and two pesticides (delta-BHC and gamma-BHC) were detected at Station SW-14. Numerous metals were also found above background at this station including aluminum, arsenic, barium, cadmium, chromium, lead, manganese, mercury, nickel, vanadium, and zinc. Station SW-14 is located in a wetland area adjacent to the dam in Mountain Spring Lake approximately one mile from the Landfill.

The detailed analysis of the data in the RI/FS concluded that the presence of TCE in the surface water probably reflects the discharge of ground water containing TCE to the surface water. The surface water also contains aluminum, arsenic, barium, iron, manganese, mercury vanadium, and zinc in concentrations above background levels at certain sample locations. However, the arsenic, mercury, and vanadium cannot be shown to have originated from the Landfill. Aluminum, barium, iron, and manganese may originate from the Landfill, although these metals may have other local sources as well. None of the numerous contaminants at Station 14 can be shown to have originated from the Butz Landfill.

Sediment samples were collected at the same time and the same locations as the surface water samples on December 10-11, 1990. Samples were analyzed for pH, total organic carbon, grain size, and Target Compound List organic compounds and Target Analyte List inorganic elements. The pH of the sediments generally reflects the surface water pH, ranging from 5.78 to 7.39. The total organic carbon content of the sediment ranged from a low value of 1200 mg/kg at Station 07 to a high value of 888,000 mg/kg at Station 14. The value at Station 14 is anomalously high as the average value for the other 13 stations was 18,925 mg/kg.

The only volatile organic compound detected in the sediment was toluene which was found at Station 06 in a concentration of 16 ug/kg. A number of polycyclic aromatic hydrocarbons (PAHs) were found at Stations 06 and 09. The highest concentration of any of the PAHs was fluoranthene found at 580 ug/kg at Station 09. Station 09 is located immediately adjacent to a parking lot used by a utility company (adjacent to Route 715) and the presence of PAHs at this station may be attributed to roadway runoff. Because the PAHs are not found at stations immediately downgradient from the Landfill (such as Station 13), it is not likely the PAHs at Stations 06 and 09 are Landfill-related.

Numerous metals were present in the sediment above background concentrations (background concentrations were measured at SW-15 and SW-16). Aluminum was present at Stations 10 and 13 in a maximum concentration of 14,700 mg/kg. Arsenic was present at Station 09 in a concentration of 5.9 mg/kg. Barium was present at Stations 02, 05, 09, 13, and 14 in a maximum concentration of 54.5 mg/kg. Beryllium was present at all stations except 01, 09, 11, and 14 in a maximum concentration of 2.2 mg/kg. Cadmium was present at Stations 02 and 04 in a maximum concentration of 2.2 mg/kg. Chromium was present at Station 09 at 49.4 mg/kg. Cobalt was present at Stations 02, 10, 13 in a maximum concentration of 32.5 mg/kg. Copper was present at Stations 09, 10, and 14 in a maximum concentration of 251 mg/kg. Iron was present at Stations 05, 09, 13 in a maximum concentration of 52,700 mg/kg. Lead was present at Stations 02, 09, 10, and 14 in a maximum concentration of 266 mg/kg. Manganese was present at Stations 02, 09, 10, and 13 in a maximum concentration of 17,800 mg/kg. Nickel was present at Stations 02, 05, and 09 in a maximum concentration of 13.9 mg/kg. Finally, zinc was present at Stations 02, 09, 10, 13, and 14 in a maximum concentration of 822 mg/kg.

The above listing included any metal found in a concentration above background. However, the source of many of the metals present in the sediment cannot clearly be determined.

5.5 ECOLOGICAL INVESTIGATION

An ecological investigation was performed along the streams and stream banks in the vicinity of the Landfill to evaluate potential environmental impacts of the site. The work was performed in mid-February, 1991. Nine (9) macroinvertebrate stations were sampled and included Stations 02, 03, 04, 05, 07, 09, 11, 13, and 15. These stations correspond to the surface water and sediment sampling stations. Station 04 was upgradient of the Landfill and Station 15 was outside the potentially impacted area of the Landfill. No contaminants were expected to be present at these two stations. The remaining stations were sampled to address the extent, if any, of impact to the local ecology.

All of the sample stations were located on first-order streams (i.e. streams which have no tributaries), except ECOL-09 which is second order (i.e. a stream which has first-order streams as tributaries). Estimated stream flow ranged from 0.003 to $0.18 m^3/s$ for the first-order stations, and $0.414\ m^3/s$ for ECOL-

09. Station ECOL-13 was located where surface water discharges from a wetland and was nearly stagnant. The dominant inorganic substrate was cobble, except at ECOL-04 and ECOL-13, where it was silt.

The overall ecological assessment of the aquatic community represented at most of the stations indicates healthy conditions when compared to the reference station. ECOL-05 appears to have a shift in community structure, but appears to be healthy. ECOL-9 was a second-order stream and therefore had some different parameters but appeared healthy. The community shift between stream orders is due to habitat changes.

The aquatic investigation indicated an overall excellent aquatic community and habitat. The stream at the reference station was slightly smaller than at the other stations, however, the stream characteristics and community appeared to be representative of headwaters in this area. Numerous sensitive organisms were collected. Diversity of organisms was superb. The only exception was found at ECOL-13 where ecological impairment was evident. The poor habitat which is naturally present at this location, as well as potential impacts caused by the discharge of contaminated ground water from the shallow aquifer, contribute to the impairment. ECOL-13 is located southeast--downgradient--of the Landfill. (It is significant that, as noted previously, no leachate generation nor incidences of ground water intrusion were evident at the Landfill itself during the Remedial Investigation). The streams in the area of the Landfill are ranked as High Quality Cold Water Fish Streams (HQ-CWF) by the State of Pennsylvania. The aquatic community reflects this ranking.

The terrestrial walk-through which was conducted for the purposes of the RI/FS revealed that the Landfill is experiencing early successional growth typical of a disturbed area in that region. There is poor surface soil present in some areas on the Landfill resulting in patches of sparse vegetative growth. Given time, the vegetation will eventually return to woodland similar to that which surrounds the landfill.

The wildlife is also typical of that found in successional growth. Populations of small mammals and game species were present. Birds observed are typical of those found in the particular habitat and season of the visit. Wildlife populations utilizing the Landfill are expected to change with time as the vegetation succeeds back into forest.

6. SUMMARY OF HUMAN HEALTH RISKS

Over fifty chemicals were selected as contaminants under review at the Site including carcinogenic PAHs, VOCs, and heavy metals.

Trichloroethene was the primary contaminant at the Site. Trichloroethene was selected for evaluation for ground water (residential and monitoring wells) and surface water; however, trichloroethene was not selected for surface soil, subsurface soil, or sediment. As noted previously, trichloroethene was detected in only one subsurface soil boring sample at a relatively low concentration of 23 ug/kg. Several carcinogenic PAHs were selected as contaminants under review for subsurface soil and sediment. PCBs were detected only once in surface and subsurface soils at the Site. Arsenic, beryllium, and mercury were the primary inorganic contaminants selected for evaluation. For sediments, some stations closest to the Site were found to be the most contaminated, especially with regard to inorganics. However, for surface water, some of the most contaminated stations were the greatest distance from the Site. The source of many of the inorganic and semi-volatile contaminants is unclear, especially for surface water. For example, mercury was selected as a contaminant under review at several surface water stations, however, it was not present in any other media. In addition, levels of mercury increased further downstream from the Site. This suggests that mercury is probably not Site-related.

The following current land-use exposure pathways were quantitatively evaluated:

- ingestion of untreated ground water from residential wells in the vicinity of the Landfill;

- dermal absorption of untreated ground water while bathing from residential wells in the vicinity of the Landfill;

- inhalation of VOCs while showering using untreated ground water from residential wells in the vicinity of the Landfill;

- direct contact with surface water and sediments by children playing in streams and seeps in the vicinity of the Landfill;

- dermal absorption of ground water by hypothetical residents while showering; and

- ingestion of fish caught in streams in the vicinity of the Landfill by recreational fisherman.

The following future land-use exposure pathways were quantitatively evaluated in this report:

- ingestion of ground water at the Site by future hypothetical residents; and

- o inhalation of VOCs while showering by future hypothetical residents who use ground water at the Site.

Exposure point concentrations were estimated for each contaminant and exposure pathway. Exposure point concentrations and exposure parameter values were combined using a chemical intake equation to estimate exposure, i.e., chronic daily intake [CDI] for the reasonable maximum exposure (RME) case for each contaminant and pathway. Toxicity criteria and CDIs were combined to quantify potential carcinogenic risk and noncarcinogenic hazards associated with the exposure pathways quantitatively evaluated in the baseline risk assessment.

Potential carcinogenic risk was quantified by multiplying the CDI by the carcinogenic slope factor (risk per milligram per kilogram per day of dose) when the cancer risk was less than 10^{-2}. (At cancer risks greater than 10^{-2}, the full exponential form of the multistage model was used.) Chemical-specific cancer risks were summed in order to quantify the total cancer risk associated with exposure to a chemical mixture. Potential carcinogenic risks are expressed as an increased probability of developing cancer over a lifetime (i.e., excess individual lifetime cancer risk) (USEPA 1989a). For example, a 10^{-6} increased cancer risk can be interpreted as an increased risk of 1 in 1,000,000 for developing cancer over a lifetime if an individual is exposed as defined by the pathways presented. A 10^{-6} increased cancer risk is the point of departure established in the National Oil and Hazardous Substances Pollution Contingency Plan ("NCP") (USEPA 1990). In addition, the NCP (USEPA 1990) states that "for known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between 10^{-4} and 10^{-6}." Carcinogenic risks in excess of the acceptable risk range are likely to trigger a remedial response. Carcinogenic risks within the acceptable risk range, yet in excess of the point of departure (i.e., 10^{-6}), also may trigger a remedial response.

Noncarcinogenic effects associated with exposure to a contaminant was quantified by dividing its CDI with its reference dose (RfD). This ratio is called the hazard quotient. If the hazard quotient exceeds unity (i.e., 1), then an adverse health effect may occur. If the estimated hazard quotient is less than unity, then adverse noncarcinogenic effects are unlikely to occur. The potential risk from a chemical mixture was evaluated by calculating the hazard index which is the sum of the chemical-specific hazard quotients.

A summary of the potential carcinogenic risks and noncarcinogenic hazards estimated for the exposure pathways quantitatively evaluated in the Butz Landfill Site baseline risk assessment are presented in Table 11.

<u>6.1 Current Use Conditions: Use of Untreated Ground Water from Residential Wells in the Vicinity of the Butz Landfill Site</u> - Of the 57 residential wells sampled by EPA, 31 had detectable concentrations of VOCs while the remaining residential wells (i.e., 26) had no detectable concentrations of volatile organic compound (VOC) contaminants. Trichloroethene (TCE) was the most frequently detected contaminant in residential wells. Other VOCs detected in residential wells included 1,1-dichloroethene, 1,2-dichloroethene, 1,2-dichloroethane, methylene chloride, and tetrachloroethene. No VOCs were detected in the 5 residential and business wells sampled during the RI.

The contaminant concentrations detected in the ground water during the RI include: vinyl chloride (up to 13 ppb); tetrachloroethene (up to 4 ppb); trichloroethene (TCE, up to 8,400 ppb); 1,2-dichloroethene (total of cis and trans) (up to 950 ppb); and 1,1-dichloroethene (up to 14 ppb). Maximum contaminant levels (MCLs) have been established under the Safe Drinking Water Act for: vinyl chloride (2 ug/l); tetrachloroethylene (5 ug/l); TCE (5 ug/l); 1,1-dichloroethene (7 ug/l); and trans-1,2 dichloroethene (100 ug/l). In addition, non-enforceable maximum contaminant level goals (MCLGs) have also been established under the Safe Drinking Water Act for these compounds. MCLGs for 1,1-dichloroethene, trans-1,2-dichloroethene and 1,2 dichloroethene are the same as the MCLs. The MCLG for tetrachloroethylene, TCE, and vinyl chloride is 0.0 ug/l.

The primary routes of possible human exposure to the volatile organic contaminants in the ground water from the Butz Landfill Site are ingestion, inhalation (during showering), and dermal contact. Vinyl chloride is a known ("Group A") human carcinogen; TCE and tetrachloroethene are suspected ("Group B2") human carcinogens; 1,1-dichloroethene is a possible ("Group C") human carcinogen. Exposure to high concentrations of TCE in air may cause irritation of the eyes, nose, and throat. Skin contact with TCE may cause dermatitis. Chronic exposure to vinyl chloride may cause hepatic damage, angiosarcoma of the liver, and excess cancer of the lung, lymphatic and/or nervous systems. Trans-1,2-dichloroethene can act as a primary irritant producing dermatitis and irritation of mucous membranes. It can also act as a narcotic, causing central nervous system depression.

Potential carcinogenic risk and noncarcinogenic hazards to residents were estimated for ingestion and dermal absorption exposure to untreated ground water and inhalation of VOCs while showering, in order to evaluate the no-action alternative. Of the 62 residential wells sampled during the various EPA sampling events, the potential carcinogenic risk associated with ingestion, dermal absorption exposure, and inhalation exposure for 31 residential wells exceeded the NCP point of departure

(10^{-6}) (USEPA, 1990). With respect to the spatial distribution of wells, carcinogenic risks for residential wells which exceeded a 10^{-6} cancer risk extended approximately 0.5 miles south/southwest of the Landfill and 1 mile east and southeast of the Landfill. However, the potential carcinogenic risks associated with use of untreated ground water from only 8 residential wells (See Table 6-60) exceeded the upper-bound of the NCP acceptable risk range (i.e., $>10^{-4}$). Most of these residential wells are located within approximately 1,000 feet of the Landfill. Figure 15 shows the locations of residential wells with the associated 10^{-6} carcinogenic risk for each well.

For noncarcinogenic hazards, the hazard indices for most of the residential wells were below unity by more than an order of magnitude. Therefore, noncarcinogenic effects associated with use of untreated ground water are unlikely to occur. Of the 62 residential wells evaluated in this report, the hazard index (HI) exceeded or equaled one for 10 residential wells; with F. Possinger (HI=105) and L. Rinker (HI=74) having the highest hazard indices. Trichloroethene was the only contaminant with a hazard quotient above unity. Noncarcinogenic effects may occur from chronic use of untreated ground water from these wells due to trichloroethene exposure. Figure 16 shows the location of the residential wells and the associated non-carcinogenic hazard for each well.

6.2 Current Use Conditions: Direct Contact with Surface Soil by Children Playing at Butz Landfill - Potential carcinogenic risks to children playing in surface soil at Butz Landfill due to dermal absorption and incidental ingestion were below the NCP point of departure (i.e., 10^{-6}). Aroclor-1260 and beryllium which are considered probable human carcinogens (Group B2) were the only potential carcinogenic contaminants identified in surface soil. Levels of arsenic in surface soil may be of more concern than the other contaminants evaluated, however, this compound was within natural background levels. With respect to noncarcinogenic hazards, all of the contaminant-specific hazard quotients, as well as the hazard index, were below unity (1) by at least two orders of magnitude. Therefore, noncarcinogenic effects associated with direct contact with surface soil while at the Butz Landfill are unlikely to occur.

6.3 Current Use Conditions: Direct Contact with Surface Water and Sediments by Children Playing in Streams and Seeps - The potential carcinogenic risks associated with dermal absorption of contaminants in surface water and sediments at all sample locations were well below the NCP point of departure (i.e., 10^{-6}) except for Stations 13 and 14 (USEPA 1990). With respect to noncarcinogenic hazards, the hazard indices estimated for the dermal absorption route for all stream and seep locations were several orders of magnitude below unity (1). The hazard indices estimated for Mountain Spring Lake, however, slightly exceeded unity (1) due to exposure to arsenic, cadmium, manganese, and zinc. The target organs for these chemicals at such dose levels are not similar, and the summing of hazard quotients may not be appropriate. Therefore, noncarcinogenic effects may not occur. At any rate, the chemicals of potential concern detected at Mountain Spring Lake are not linked to Site-related activities. Direct contact with surface water and sediments in the vicinity of the Landfill does not appear to present appreciable risk to children.

Probable human carcinogens identified as contaminants in sediments include beryllium (Stations 2, 6, 10, 13), benzo(a)pyrene (Equivalent) (Stations 6 and 9), and bis(2-ethylhexyl)phthalate (Station 9). Arsenic, a known human carcinogen, was identified as a contaminant under review at Stations 2, 9, and 13. The potential carcinogenic risks associated with incidental ingestion of sediments at Stations 2, 6, 9, 10, and 13 slightly exceeded the NCP point of departure (i.e., 10^{-6}), yet were within the NCP acceptable risk range (i.e., $<10^{-4}$) (USEPA 1990). Potential carcinogenic risks ranged from $2x10^{-6}$ (Station 6) to $3x10^{-5}$ (Station 13).

With respect to noncarcinogenic hazards, hazard indices estimated for all stream and seep locations were below unity (1) and ranged from $4x10^{-2}$ (Station 10) to $4x10^{1}$ (Station 2). Therefore, noncarcinogenic effects associated with incidental ingestion of sediments while playing in streams and seeps in the vicinity of the Site are unlikely to occur.

It should be noted that it was conservatively assumed that children would play 125 days per year for 10 years at a given location and would ingest 140 milligrams of sediment per day (USEPA 1989a, 1991d). In addition, it is not evident that the contaminants detected at each station are actually associated with Site-related disposal activities. For example, surface water runoff from roads may contaminate streams with PAHs which are formed from the incomplete combustion of hydrocarbons from vehicles or from the asphalt road surface itself.

<u>6.4 Current Use Conditions: Ingestion of Contaminated Fish</u> - The potential carcinogenic risks associated with ingestion of fish due to exposure to trichloroethene from all sample locations were below the NCP point of departure (i.e., 10^{-6}) (USEPA 1990). With respect to noncarcinogenic hazards, mercury, which was detected at Stations 1, 3, 6, and 9, was the only contaminant with a hazard quotient exceeding unity (1). The concentrations of mercury detected in surface water ranged from 0.25 to 1 ug/L, which exceeds the USEPA Ambient Water Quality Criteria (AWQC) of 0.15 ug/L for consumption of fish (USEPA 1986c). Thus, recreational fisherman who ingest 54 grams of fish per day for thirty years from one of these locations (i.e., Stations 1, 3, 6 or 9) may experience an adverse health effect. However, the

Site-relatedness of mercury is doubtful. Mercury was not detected in ground water monitoring wells, surface soil, subsurface soil borings, or test pit samples collected at the Site. In addition, the levels of mercury along the North Fork of Reeders Run increase further downstream from the Landfill.

6.5 Future Land-Use Conditions: Use of ground water by Hypothetical Residents at the Butz Landfill Site - If ground water at the site were used as a source of water in the future, then residents may be exposed to contaminants via ingestion, dermal absorption exposure, and inhalation of VOCs while showering. The total potential carcinogenic risk from ingestion and dermal absorption exposure to ground water and inhalation of VOCs while showering is 3×10^{-3}. This risk exceeds the NCP point of departure (i.e., 10^{-6}) and upper-bound of the NCP acceptable risk range (i.e., 10^{-4}) (USEPA 1990). The majority of the risk is associated with ingestion, dermal absorption exposure, and inhalation of trichloroethene. The highest detected concentration of trichloroethene was found at monitoring well R1D which is located along the eastern boundary of the Landfill property. With respect to noncarcinogenic hazards, the hazard index associated with use of ground water at the Butz Landfill exceeded unity by a factor of 183, mainly due to trichloroethene. Trichloroethene, 1,2-dichloroethene, and antimony were the only contaminants with hazard quotients that exceeded one. Therefore, noncarcinogenic effects from ingestion of ground water from the Butz Landfill Site may occur, in addition to carcinogenic risks, if this aquifer were to be utilized as a water resource in the future.

7.0 SUMMARY OF ECOLOGICAL RISKS

The terrestrial ecology on the Landfill does not appear to be impacted by any organic compounds or inorganic elements found in the surface soils. The contaminants in the surface soils, primarily heavy metals, are not present at levels sufficient to cause toxicity to either the vegetation or wildlife. Both organic and inorganic contaminants were present in the subsurface soil of the Landfill. These contaminants were not uniformly dispersed, and it was assumed that terrestrial wildlife would not typically come in contact with organic compounds. The subsurface soils were noted to be hard and mixed with crushed shale. This soil type is not expected to be utilized by burrowing soil invertebrates. During the course of two site walk-throughs, numerous signs and sightings of small mammals, game animals, and avian species were observed. The vegetation was typical of that which is expected to occupy a successional field.

The aquatic communities within the tributaries at and near the Site were of excellent quality. Rich diversities, high abundances, stable and high quality habitats, good water quality, and impressive representation of sensitive organisms indicate no ecological impairment. Insignificant levels of organics and low levels of inorganics do not appear to be affecting the aquatic community, nor do they pose a concern when compared to values from toxicological literature.

The exception occurred at Station 13, where manganese and arsenic occurred at levels sufficient to pose a potential risk and iron and aluminum concentrations were approaching levels which may cause risk (surface and subsurface soil samples do not implicate the Landfill as the source of the arsenic). These metals combined are expected to contribute to limited risk. It should be noted that the stream habitat evaluation revealed that the stream section associated with Station 13 was poor in quality. Heavy sedimentation, poor flow (almost stagnant), high seasonal flow variation, and poor stream substrate (i.e. lack of cobble and other attachment sites) were the primary poor stream parameters. Iron flocculent was also observed at this station. The benthics collected at SW-13 were fair. However, when compared to the other excellent stations, Station 13 was considered poor. ECOL-13 naturally supports a lower quality aquatic community than is typical of the area, and manganese, iron, and aluminum, which may have been originally derived, in part, from the Landfill may be further suppressing the aquatic community. (Manganese, iron, and aluminum are not hazardous substances under CERCLA.)

A number of semi-volatiles and inorganic compounds were detected at Station 09. These compounds do not appear to be Site-related. At present, these compounds do not appear to be affecting the aquatic community. Potential sources of the contaminants may be the adjacent unpaved parking lot used by a utility company, and run-off from sprayed farm lands.

A number of contaminants were present in the surface water and sediment at Station 14. Aluminum, cadmium, iron, lead, mercury, zinc, delta-BHC, and gamma-BHC were present at levels that may be of risk to aquatic organisms. The metals previously mentioned were also present at elevated levels in the sediments. These contaminants are not likely to be Site-related because Station 14, located at the outlet of Mountain Spring Lake, is more than one mile from the Landfill. In addition, Stations 05 and 07 (located between Station 14 and the Landfill) would be expected to intercept surface water and shallow ground water discharge from the Landfill, therefore, any Site-related contamination would be expected to be detected at these stations. However, no Site-related contamination was detected at Stations 05 and 07.

8.0 RISK ASSESSMENT CONCLUSION

EPA has found no evidence of endangerment to the public health or welfare or to the environment from the Butz Landfill proper, or from surface waters or sediments which might be affected by the Site. However, actual or threatened releases of hazardous substances in ground water at the Site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment, based on the risks described above in Section 6.

9.0 DESCRIPTION OF ALTERNATIVES

Using the information collected for the purposes of the RI/FS, EPA has developed the alternatives described below for the second, and final, operable unit remedial action to address contaminated ground water.

1. NO ACTION WITH MONITORING

This alternative would not involve any remedial action, but would include ground water monitoring activities. The ground water monitoring would include the biannual sampling and analysis of water from at least three of the existing shallow aquifer monitoring wells and at least three of the existing bedrock aquifer monitoring wells for a period of 30 years. This alternative provides a means by which ground water contaminant concentrations can be quantified over time.

No construction activities would be required to implement this alternative. The capital cost associated with this alternative would be for professional consulting services to plan and implement the monitoring program. The estimated capital cost is $70,000. Annual operation and maintenance (O&M) is estimated to cost $125,000. The estimated present worth of this alternative, considering a 30-year implementation period, is $1,391,000.

2. CONTAMINATED GROUND WATER EXTRACTION, TREATMENT AND DISCHARGE

This alternative includes provisions for the active extraction and treatment of contaminated ground water from the bedrock aquifer. The alternative includes the installation of bedrock aquifer extraction wells, treatment of the extracted ground water to remove organic contaminants, and discharge of the treated water to surface streams. The wells would be placed hydrogeologically downgradient of the Landfill in the area were DNAPLs are suspected and at the perimeter of the area of contaminated ground water. This alternative provides a reduction in the toxicity, mobility and volume of the contaminants by extracting and treating the ground water. The alternative would minimize or prevent the migration of organic contaminants through the bedrock aquifer thereby reducing the likelihood that the area of contaminated ground water would increase in size. The intent of this alternative is to reduce the concentrations of organic contaminants in the aquifer to background levels.

Two of the treatment options that are available for implementation of this remedy are (1) treatment of ground water by chemical precipitation of metals and air stripping of volatile organic compounds, and (2) treatment of ground water using granular activated carbon. Option number 1 is estimated to require a capital expenditure of $5,082,000 with estimated annual O&M costs of $561,000. The estimated present worth of Option 1 is $11,012,000. Option number 2 is estimated to require $5,395,000 in capital expenditures and an estimated $861,000 in annual O&M. The estimated present worth of Option 2 is $14,995,000. The best option would be selected during the remedial design process.

10.0 SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

The two alternatives described in the preceding section for this remedial action were evaluated against the following nine criteria, as required by the NCP:

1. overall protection of human health and the environment;

2. compliance with Applicable or Relevant and Appropriate Requirements (ARARs);

3. long-term effectiveness and permanence;

4. reduction of toxicity, mobility, and volume; through treatment

5. short-term effectiveness;

6. implementability;

7. cost

8. state acceptance; and

9. community acceptance;

1. Overall Protection of Human Health and the Environment

Alternative 1, No-Action With Monitoring, has no provision for the active protection of human health or the environment. Alternative 2 would provide adequate protection of human health and the environment considering that EPA has already established plans (outside the scope of this operable unit) to construct a pipeline to supply potable water to area residents whose wells currently are, or might become, contaminated with volatile organic hazardous substances thereby eliminating the possibility of exposure. Alternative 2 will also prevent the spread of the contaminants beyond the current limits of the contaminated area.

2. Compliance with ARARs

No chemical-specific ARARs pursuant to Section 121 of CERCLA will be met by Alternative 1, No Action With Monitoring. Implementation of the No Action With Monitoring alternative would not trigger any location-specific nor action-specific ARARs.

ARARs relevant to Alternative 2 are discussed in detail in Section 14 of this ROD. Alternative 2 will assure that no residents are exposed to any Site-related hazardous substances in ground water which exceed the requirements set forth as Maximum Contaminant Levels (MCLs) or (non-zero) Maximum Contaminant Level Goals (MCLGs) under the federal Safe Drinking Water Act and under the Pennsylvania Safe Drinking Water Act. This alternative would be designed for the purpose of remediating ground water to meet the Commonwealth of Pennsylvania requirement for cleanup of ground water to background concentrations. Since no Site-related volatile organic contaminants were detected in background samples, the requirement to meet MCLs and non-zero MCLGs will, therefore, also be met.

Alternative 2 would comply with all location-specific ARARs (e.g. wetlands preservation requirements) involved in the siting of the extraction wells, piping, treatment units and other equipment. The Alternative would also comply with all action-specific ARARs (e.g. air emission standards and effluent discharge standards) required for the construction activities and the functioning of the extraction and treatment equipment.

The Commonwealth of Pennsylvania regulations regarding closure of municipal waste landfills are not applicable because those regulations were promulgated in 1988 and the Landfill ceased operations in 1973. The regulations would be relevant and appropriate if 1) the regulations addressed problems or situations sufficiently similar to those encountered at the site, and 2) if the regulations were well suited for use at the site. EPA has determined that the municipal waste landfill closure regulations are not relevant and appropriate because the RI/FS showed that the Landfill is not currently contributing to the volatile organic ground water contamination, nor is it resulting in any other significant environmental or human health concerns that otherwise might be addressed by landfill closure pursuant to those regulations. The Landfill was closed under an agreement between the Landfill operators and the Pennsylvania Department of Environmental Resources in 1973.

3. Long-Term Effectiveness and Permanence

Selection of the No Action With Monitoring alternative is unlikely to achieve a reduction in the size of the area currently contaminated by volatile organic compounds in the ground water.

Alternative 2 is expected to prevent further contamination of the bedrock by actively pumping the ground water in the vicinity of the Landfill where DNAPLs are suspected to be present. This Alternative would also be expected to prevent the enlargement of the area of contamination. The ground water extraction system would require continuous maintenance. This alternative is effective in the long-term because the cleanup levels (i.e., background) will be met in the area of attainment.

4. Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternative 1, No Action With Monitoring, would provide no reduction of toxicity, mobility, nor volume of any of the ground water contaminants. Alternative 2, contaminated Ground Water Extraction, Treatment and Discharge, would result in a reduction of volatile organic contaminants by removing those contaminants from the extracted ground water prior to effluent discharge. Under this alternative, the mobility of the contaminants would be restricted because the pumping and extraction of the ground water would cause an alteration of the ground water flow pattern resulting in the contaminated ground water being directed toward the extraction wells. Because the volatile organic compounds would be removed from the ground water via a treatment process, the concentrations of those compounds would be reduced thereby reducing toxicity.

5. Short-Term Effectiveness

The No Action With Monitoring alternative would not eliminate the threats posed by the possible spread of contaminated ground water as described in Sections 6 and 8, above.

Alternative 2, upon commencement of ground water extraction, would result in alteration of the flow of ground water and reduction of the contaminant concentrations. The alternative would reduce the likelihood area of further contamination of the bedrock aquifer and would prevent the contamination from spreading.

6. Implementability

Both alternatives are implementable. The No Action With Monitoring alternative requires monitoring of existing ground water wells for volatile organic contaminants. The resources for this alternative are available and are considered to be routine exercises in sampling and analysis.

The technologies required to implement Alternative 2 are well-established and commercially available. This alternative would possibly require negotiations with private land owners for access, for the establishment of maintenance roadways, for the construction of the extraction wells and treatment units, and for the extension of electrical service.

7. Cost

The present worth of the No Action alternative is estimated to be $1,391,000. The present worth of Alternative 2 is estimated to range between $11,012,000 and $14,995,000 depending on the treatment scenario that would be chosen as a result of the remedial design activities as previously described. The estimates for both alternatives are predicated upon the assumption that either alternative would require 30 years for implementation.

8. State Acceptance

The Commonwealth of Pennsylvania concurs with the selection of Alternative 2. A copy of the concurrence letter is attached.

9. Community Acceptance

Only one letter commenting on the Proposed Remedial Action Plan was received by EPA. That letter expressed opposition to the selection of Alternative 2 mainly because of the cost of the alternative.

11. THE SELECTED REMEDY

After careful consideration of the proposed remedial action alternatives and evaluation of the nine criteria listed above, and the public comments, EPA has selected Alternative 2, Contaminated Ground Water Extraction, Treatment and Discharge as the appropriate remedy for meeting the goals for this second operable unit at the Butz Landfill Site. In the judgment of EPA, the remedy selected represents the best balance among the criteria evaluated. The selected alternative consists of:

1. Construction of ground water extraction wells downgradient from the Landfill in the area of suspected DNAPLs and at the perimeter of the area of contamination. The number of wells and the extraction rates shall be sufficient to prevent the contaminated ground water from expanding into other areas and to extract the volatile organic contaminants from the contaminated ground water in order to achieve background levels and to return ground water to its beneficial use as a source of drinking water.

2. Construction of piping and treatment units, as required, to achieve the necessary extraction and routing of ground water, the treatment of the ground water to remove contaminants to NPDES-allowed levels, and the discharge of treated water to surface streams.

3. Construction of access roads and electric power lines as required.

4. The operation and maintenance of the ground water extraction, treatment and disposal system until contaminants in the ground water at the Site are at background concentrations, in accordance with the performance standards set forth in (12), below. EPA will operate or direct operations of the system for a maximum of 10 years. If a period of greater than 10 years is required, the system will be turned over to the Commonwealth of Pennsylvania for continuation of the operation and maintenance pursuant to Section 104(c)(6) of CERCLA.

A schematic drawing of the possible locations of the ground water extraction wells is included in this ROD as Figure 17. The actual number of wells and the locations of the wells and other equipment would be determined during pre-design and/or design activities. Table 12 gives a breakdown of various cost items for the ground water treatment option employing chemical precipitation and air stripping. Table 13 is an estimate of the cost items for the carbon absorption option.

12. PERFORMANCE STANDARDS

The selected remedy will achieve background levels for all of the volatile organic contaminants in the ground water thereby restoring the ground water to its beneficial use as a source of drinking water. The Pennsylvania ARAR for hazardous substances in ground water, 25 PA Code §§ 264.90 -264.100, specifically, 25 PA Code §§ 264.97(i) and (j) and § 264.100(a)(9), is relevant and appropriate under the circumstances at the Butz Landfill Site. The listed chapter citations require that ground water must be remediated to "background" quality. The Commonwealth of Pennsylvania also maintains that the requirement to remediate to background is also found in other legal authorities. For the purposes of this remedy, the background ground water sampling location is EPA-installed monitoring well R5 (see Figure 2). No volatile organic compounds were detected in this well during the RI/FS. The remedy therefore will achieve non-detectable levels of volatile organic compounds in ground water for the entire site. The requirement to meet MCLs and non-zero MCLGs will, therefore, also be met. The background concentrations will be determined by EPA based on available technologies and methodologies during the remedial action. As of the date of this ROD, the appropriate methods of analysis are 40 C.F.R. Part 136 (Series 601 and 602), and 40 C.F.R. Part 141 (series 524.2).

All extracted ground water will be treated to levels which will allow for discharge into nearby surface water streams in compliance with the requirements of State (25 PA Code Chapters 92, 93 and 95) and Federal discharge regulations.

13. POSSIBLE EVENTS IF THE REMEDY IS NOT ACHIEVED

If at any time during the design or implementation of this remedy, EPA determines that protectiveness of public health and welfare and the environment has been achieved even though the performance standards in this ROD have not been met, or, in corroboration with hydrological and chemical evidence, that it will be technically impracticable to achieve and maintain the cleanup levels throughout the area of attainment, then EPA, in consultation with the Commonwealth of Pennsylvania, may write another ROD, amend this ROD, or issue an Explanation of Significant Differences to inform the public of alternative ground water cleanup actions which may include, but not be limited to, any of the following:

a) engineering controls such as physical barriers, or long-term gradient control provided by low level pumping, as containment measures;

b) the waiving of chemical-specific ARARs for the cleanup of portions of the aquifer based on the technical impracticability of achieving further contaminant reduction;

c) institutional controls to restrict access to those portions of the aquifer which remain above remediation standards;

d) continued monitoring of specified wells; and

e) periodic reevaluation of remedial technologies for ground water restoration.

The decision to invoke any or all of these measures could be made during periodic reviews of the remedial action which will occur at least once every five years in accordance with CERCLA Section 121(c).

14. STATUTORY DETERMINATIONS

This remedy satisfies the remedy selection requirements of CERCLA and the NCP. This remedy is expected to be protective of human health and the environment, complies with ARARs, is cost effective, and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable. Because it will treat the ground water to remove contaminants, the remedy also meets the statutory preference for treatment as a principal element of the remedy. The following is a discussion of how the selected second operable unit remedial action addresses these statutory requirements:

Protection of Human Health and the Environment

The selected remedial action protects human health and the environment by cleaning up ground water such that levels of volatile organic compounds will not exceed background concentrations. All ground water extracted from the aquifer will be treated and discharged to local streams in compliance with the substantive requirements of state and federal discharge regulations.

Compliance with Applicable or Relevant and Appropriate Requirements

These standards are considered applicable to this action:

This action will cause no violation of NAAQS due to fugitive dust generated during construction activities (Clean Air Act, 40 C.F.R § 50.6 and 40 C.F.R. § 52.21(j)). Fugitive dust emissions generated during construction activities will comply with fugitive dust regulations in the Federally approved State Implementation Plan for the Commonwealth of Pennsylvania (Clean Air Act, 40 C.F.R. Part 52, Subpart NN, 52.2020 - 52.2023, State Implementation Plans for National Ambient Air Quality Standards).

Any surface water discharge will comply with the Clean Water Act NPDES discharge regulations (40 C.F.R §§ 122.41-122.50), the Pennsylvania NPDES regulations (25 PA Code § 92.31), the Pennsylvania Water Quality Standards (25 PA Code §§ 93.1-93.9) and the Pennsylvania Wastewater Treatment Regulations (25 PA Code §§95.1 - 95.3).

Handling, treatment or disposal of any residual considered a hazardous waste under 40 C.F.R. § 261.3 will comply with 40 C.F.R. §§ 264.1 - 264.50 and 25 PA Code § 75.264(v) which requirements regulate the land disposal of hazardous wastes.

Offsite transportation of contaminated materials or treatment residuals will be done in compliance with Federal regulations applicable to generators and transporters of hazardous wastes (40 C.F.R. Part 262 and 40 C.F.R. Part 263) as well as with Pennsylvania regulations (25 PA Code § 75.263).

Any disturbance of wetlands resulting because of access road construction or other construction activities will be minimized and mitigated in compliance with the substantive requirements of Section 404 of the federal Clean Water Act, the Pennsylvania Dam Safety and Encroachments Act, the 25 PA Code Chapter 105 regulations, 40 CFR Part 6.302(a), 33 CFR Part 330 et.seq., and 40 CFR Section 230.10.

Stormwater runoff and soil erosion control during construction activities will comply with the substantative requirements of the Pennsylvania Stormwater Management Act and the 25 PA Code Chapter 102 erosion control regulations.

Extraction well construction and operation will comply with the regulations of the Delaware River Basin Commission (DRBC). Applicable DRBC regulations are: DRBC Ground Water Protected Area Regulations Nos. 4, (6)(f), 9 and 10; and Water Code of the Basin, Sections 2.20.4 and 2.50.2.

These standards are considered relevant and appropriate to this action:

> The contaminated ground water will be cleaned to background contaminant levels as required by 25 PA Code §§ 264.90 - 264.100, specifically, 25 PA Code § § 264.97(i) and (j) and 264.100(a)(9).
>
> Onsite treatment will comply with RCRA regulations and standards for owners and operators of hazardous waste treatment, storage, and disposal facilities, 40 C.F.R. §§ 264.170 - 264.178 (containers), §§ 264.190 - 264.200 (tanks), §§ 264.220 - 264.249 (surface impoundments) and §§ 264.601 - 264.603 (miscellaneous units) and will comply with §§ 264.1032 - 264.1033 which regulate air emissions from process vents and §§ 264.1052 - 264.1062 which regulate air emissions from equipment leaks.

This directive is a "to be considered" criterion:

> Off-gas from any air strippers used to clean the ground water before discharge will comply with OSWER Directive 9355.0-28 which requires air pollution controls for air strippers with certain emission rates.

Cost Effectiveness

Cost effectiveness is determined by comparing the costs of the alternatives being considered with the overall effectiveness of the alternative to determine whether costs are proportional to the effectiveness achieved. The present worth cost of the ground water extraction, treatment, and disposal remedy is estimated to range from $11,012,000 for the option employing treatment of ground water by chemical precipitation of metals and air stripping of volatile organic compounds, to $14,495,000 if ground water is treated using granular activated carbon. This remedy is judged to afford overall effectiveness proportional to its cost such that the remedy represents a good value. When the relationship between cost and overall effectiveness of the remedy is compared to the cost and effectiveness of No Action With Monitoring, the only other alternative considered, the Contaminated Ground Water Extraction, Treatment, and Discharge remedy is judged to be more cost effective.

Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

EPA has determined that the selected remedial action represents the maximum extent to which permanent solutions and alternative treatment technologies can be utilized while providing the best balance among the other evaluation criteria at this time. The remedy provides the best balance in terms of the nine evaluation criteria.

Preference for Treatment as a Principal Element

The remedy satisfies the statutory preference for remedies that employ treatment as a principal element to permanently reduce the volume, toxicity, or mobility of hazardous substances. By extracting ground water from the aquifer and removing contamination from it before it is discharged to local streams, the remedy addresses the primary risk posed by the Site through the treatment.

15. Responsiveness Summary

In compliance with Section 113(d) and 117 of CERCLA, the Proposed Remedial Action Plan and the Remedial Investigation/Feasibility Study (RI/FS) were placed for public viewing at the Pocono Township Public Library, Tannersville, Pennsylvania. An announcement of the availability of these documents was placed in the Pocono Record on April 22, 1992. The Proposed Remedial Action Plan listed the alternatives developed pursuant to the information contained in the RI/FS. A period for public review and comments on the Proposed Remedial Action Plan was held from April 22, 1992 through May 22, 1992.

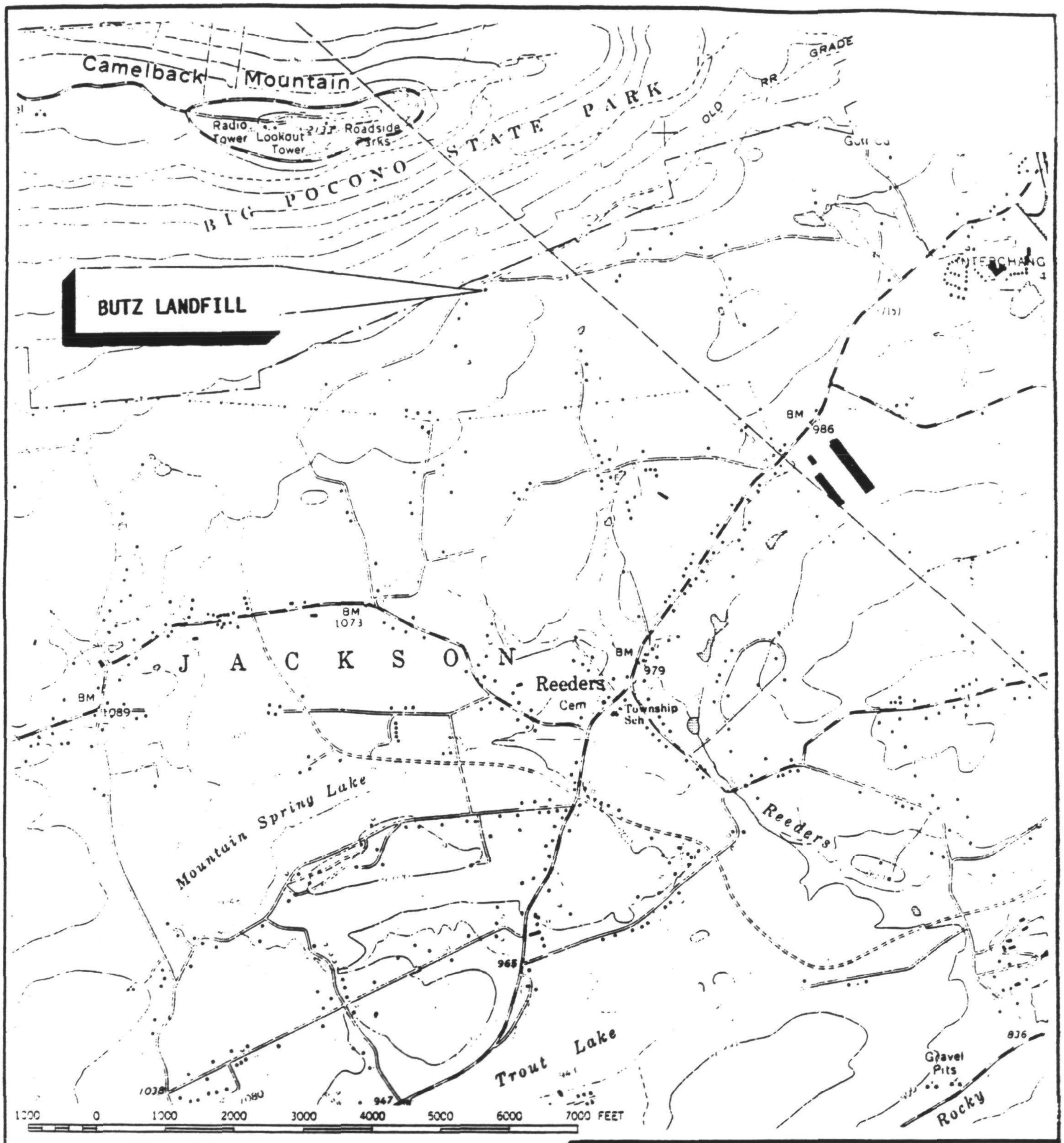
On May 7, 1992, a Public Meeting was held at the Jackson Township Municipal Building, Reeders, Pennsylvania. The meeting was attended by approximately seventy interested citizens and public officials including officials from the Pennsylvania Department of Environmental Resources. At the Public Meeting, EPA presented a brief summary of the two alternatives which were delineated in the proposed Remedial Action Plan and the reasons for EPA's preference for Alternative 2, Contaminated Ground Water Extraction, Treatment and Discharge. Most of the concerns voiced by citizens at the Public Meeting concerned the costs associated with Alternative 2. EPA answered all of the questions posed at the Public Meeting. A transcript of the Meeting has been included in the Administrative Record for the Site.

EPA received one letter of comments on the Proposed Remedial Action Plan during the comment period. That letter, dated May 13, 1992, disagrees with EPA's choice of Alternative 2, in part, because the commentor feels that the alternative is too costly, because no significant environmental effects have been shown to exist, and because the absence of treatment does not appear to have increased the areal distribution of the ground water contamination.

EPA maintains that it is necessary to clean up contaminated ground water resources and to thereby make those resources available for future use. Also, EPA is required by CERCLA to comply with ARARs unless a waiver of an ARAR is invoked. The major ARAR of concern in this regard is the Commonwealth of

Pennsylvania requirement that ground water be restored to background contaminant concentrations. The NCP also requires that ground water be restored to its beneficial use, which, in this instance, is the historic and on-going use of the ground water as a drinking water source. If, at a later time, EPA concludes that the remedy is not appropriate, EPA will then re-evaluate the remedy.

FIGURES



SOURCE: USGS TOPOGRAPHIC MAP MOUNT POCONO QUADRANGLE

FIGURE 1
GENERAL LOCATION MAP
BUTZ LANDFILL

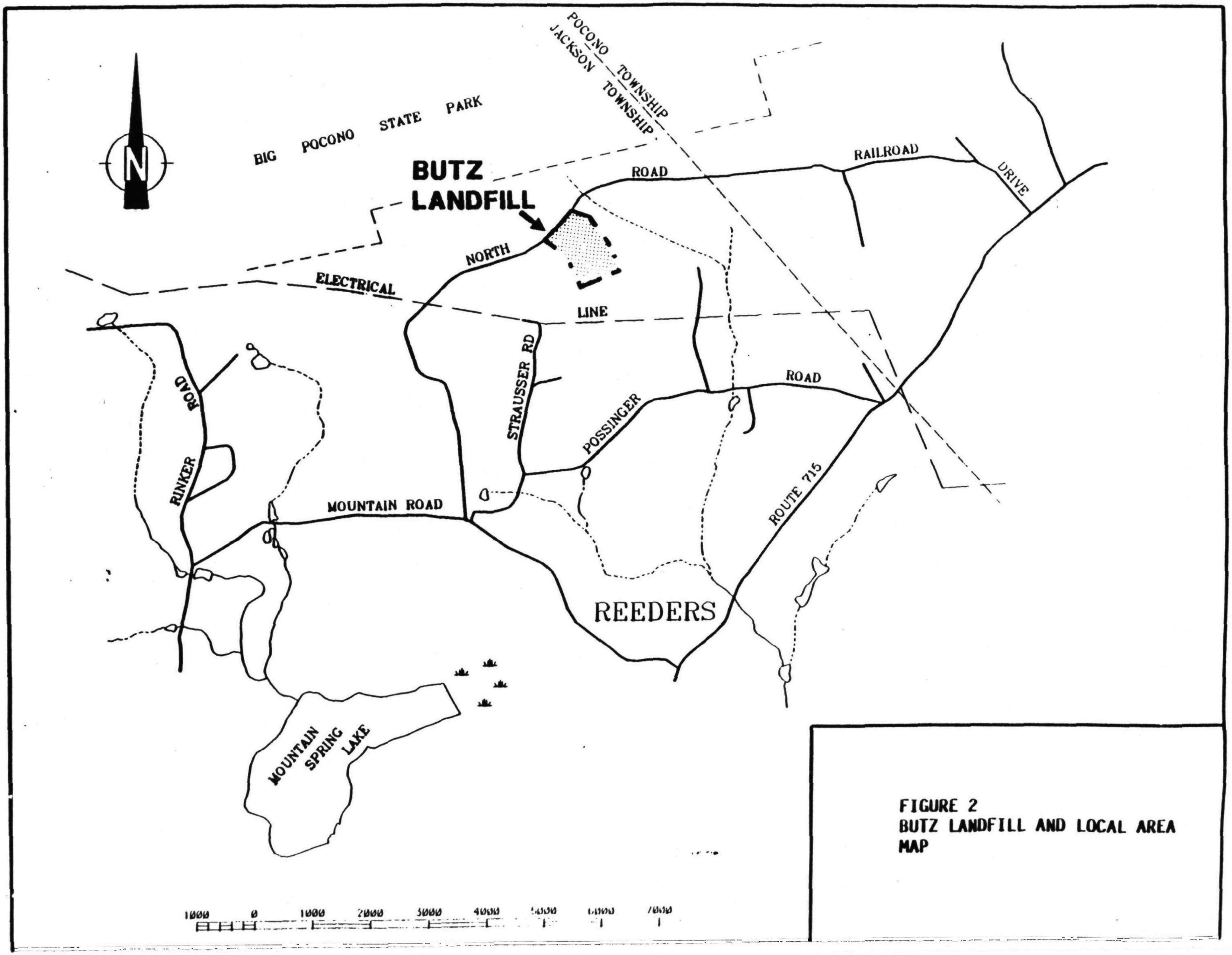


FIGURE 2
BUTZ LANDFILL AND LOCAL AREA MAP

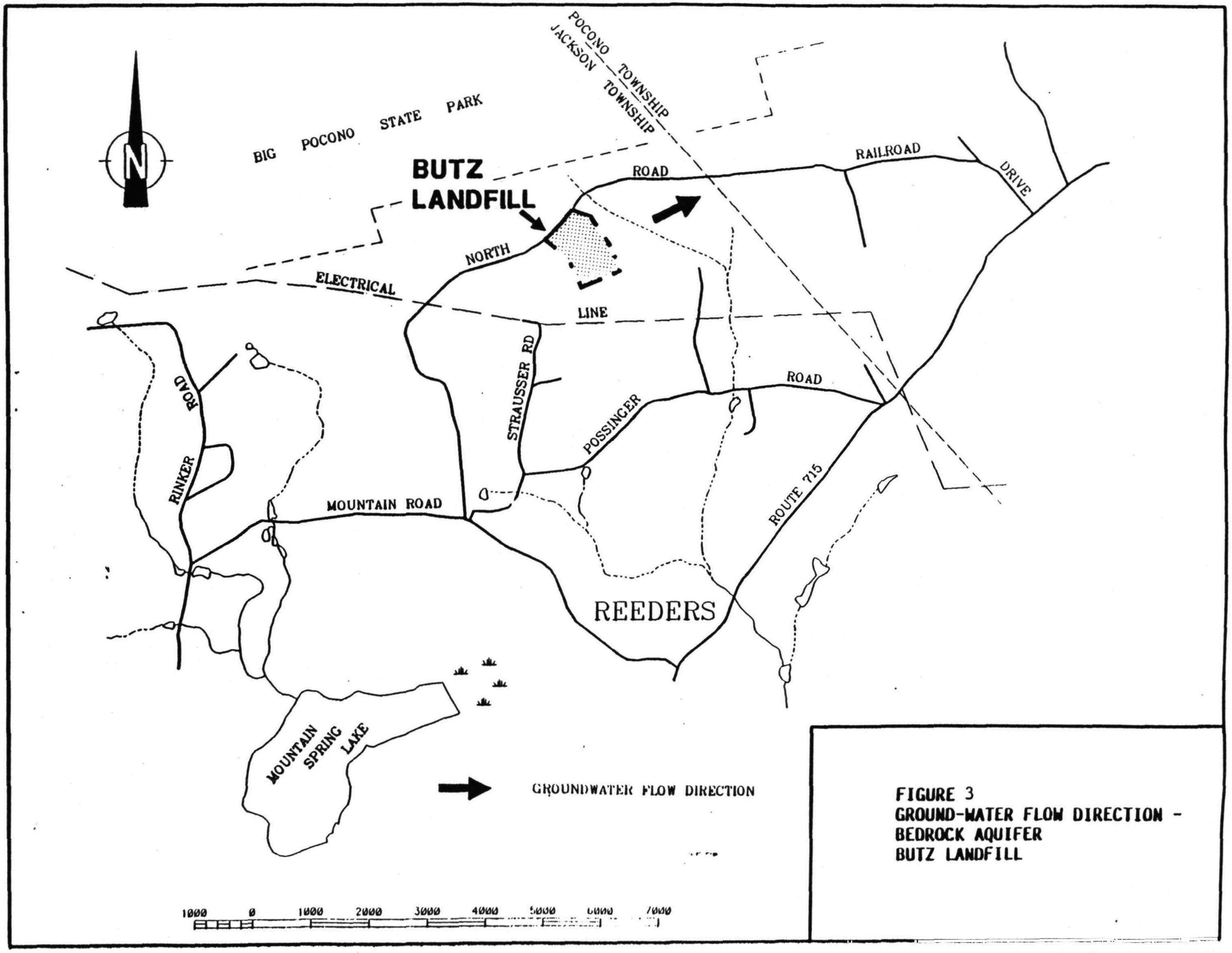
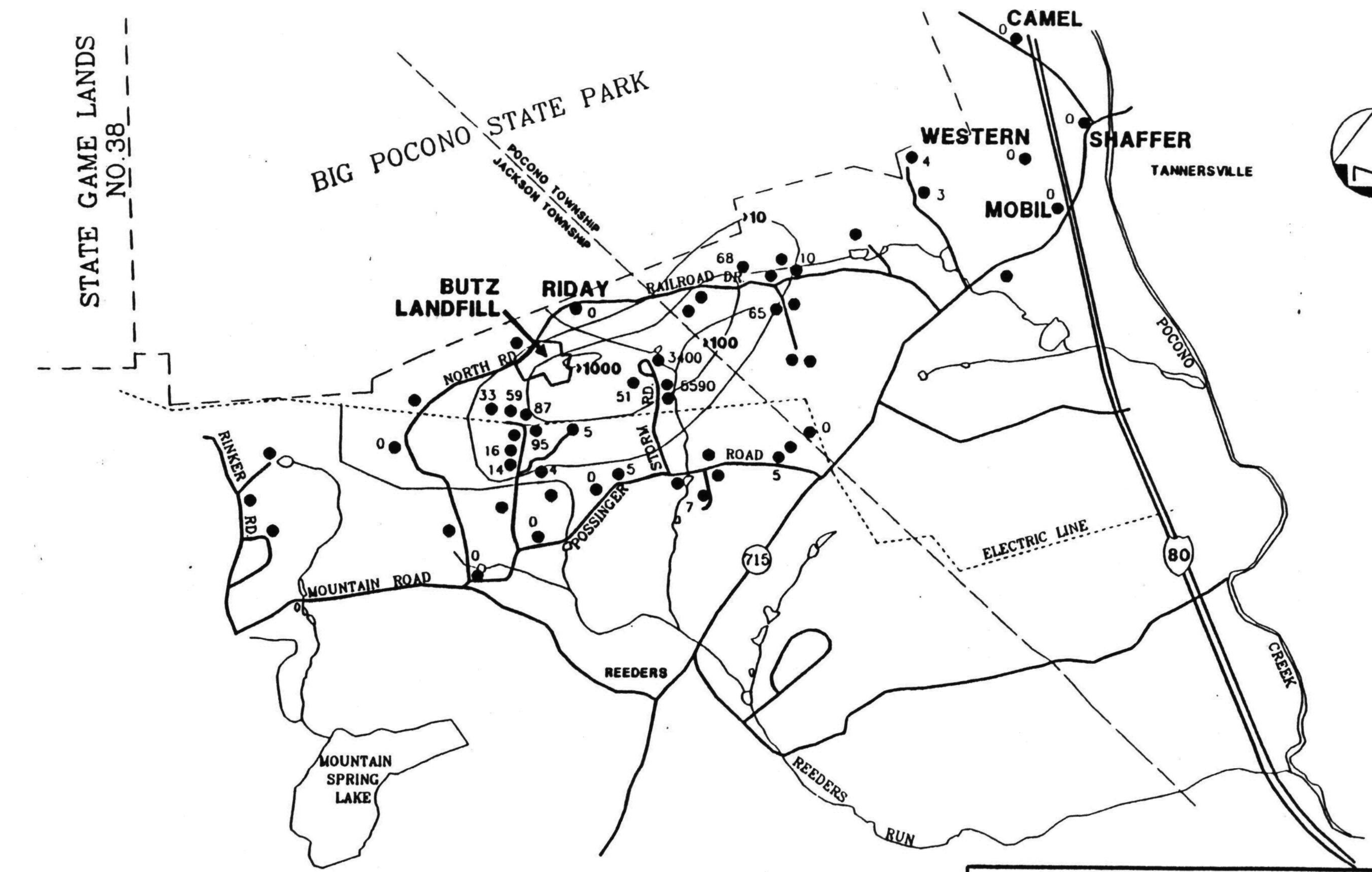


FIGURE 3
GROUND-WATER FLOW DIRECTION -
BEDROCK AQUIFER
BUTZ LANDFILL



NOTE: SEE FIG. 1-3 AND TABLE 1-2 FOR IDENTIFICATION OF RESIDENTS

LEGEND:

● TCE CONCENTRATION IN RESIDENTIAL WELL

—>100— TCE CONCENTRATIONS (ug/l)

SOURCE: USEPA TAT RESIDENTIAL WELL SAMPLING DATA. BASED ON 1990-1991 DATA

0 2500' 3000'

SCALE

FIGURE 4
DISTRIBUTION OF TCE IN RESIDENTIAL WELLS
BUTZ LANDFILL

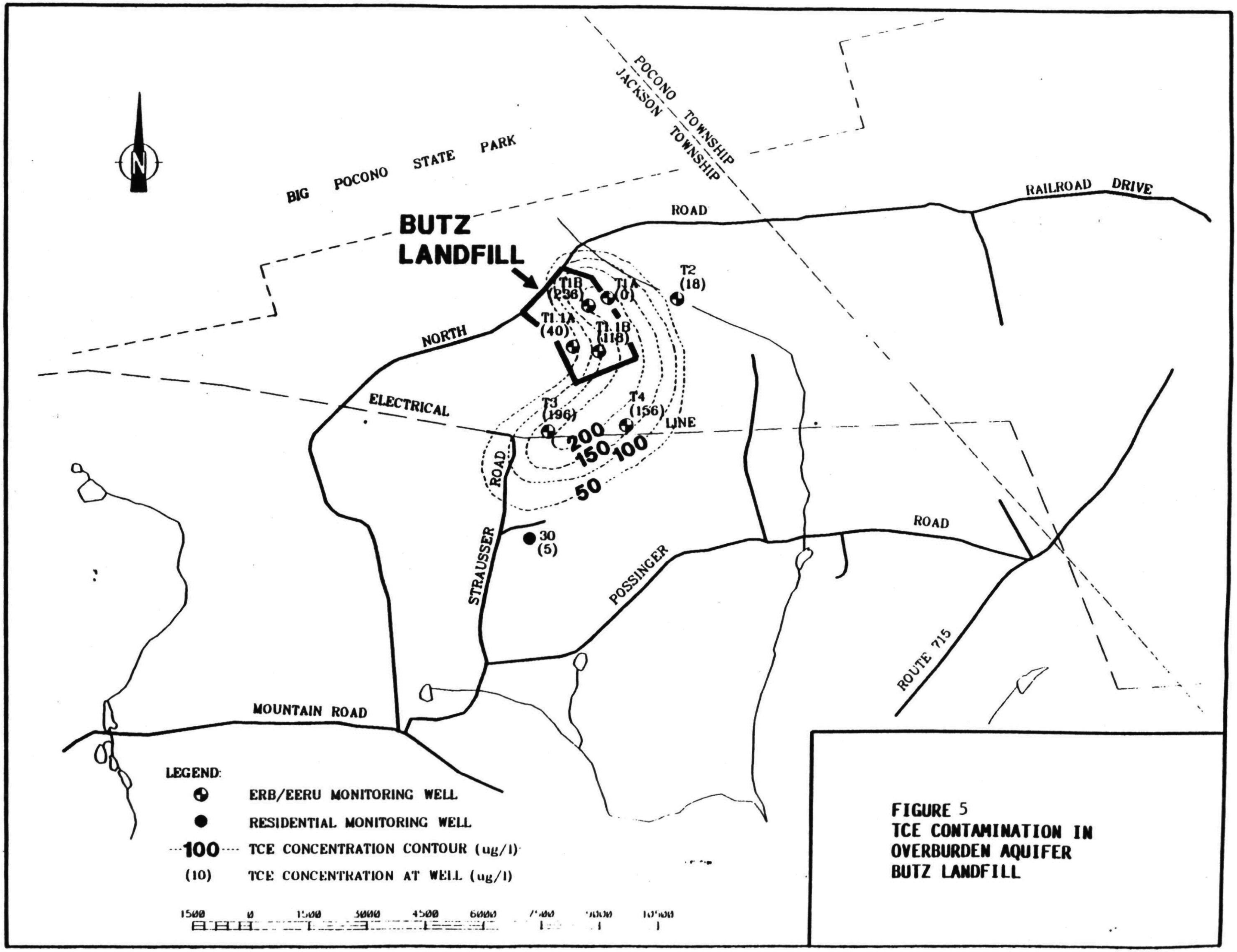
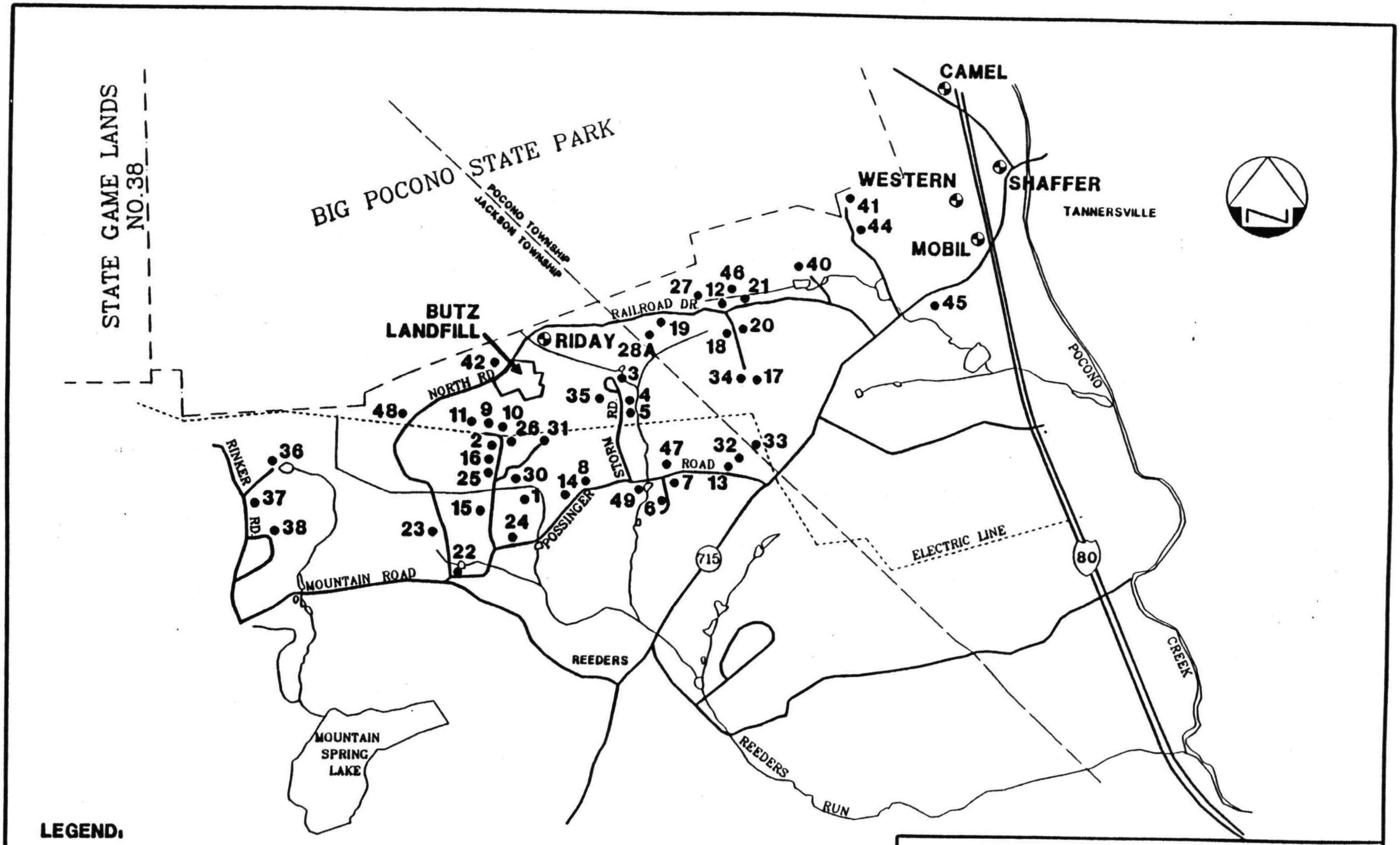


FIGURE 5
TCE CONTAMINATION IN OVERBURDEN AQUIFER BUTZ LANDFILL



LEGEND:

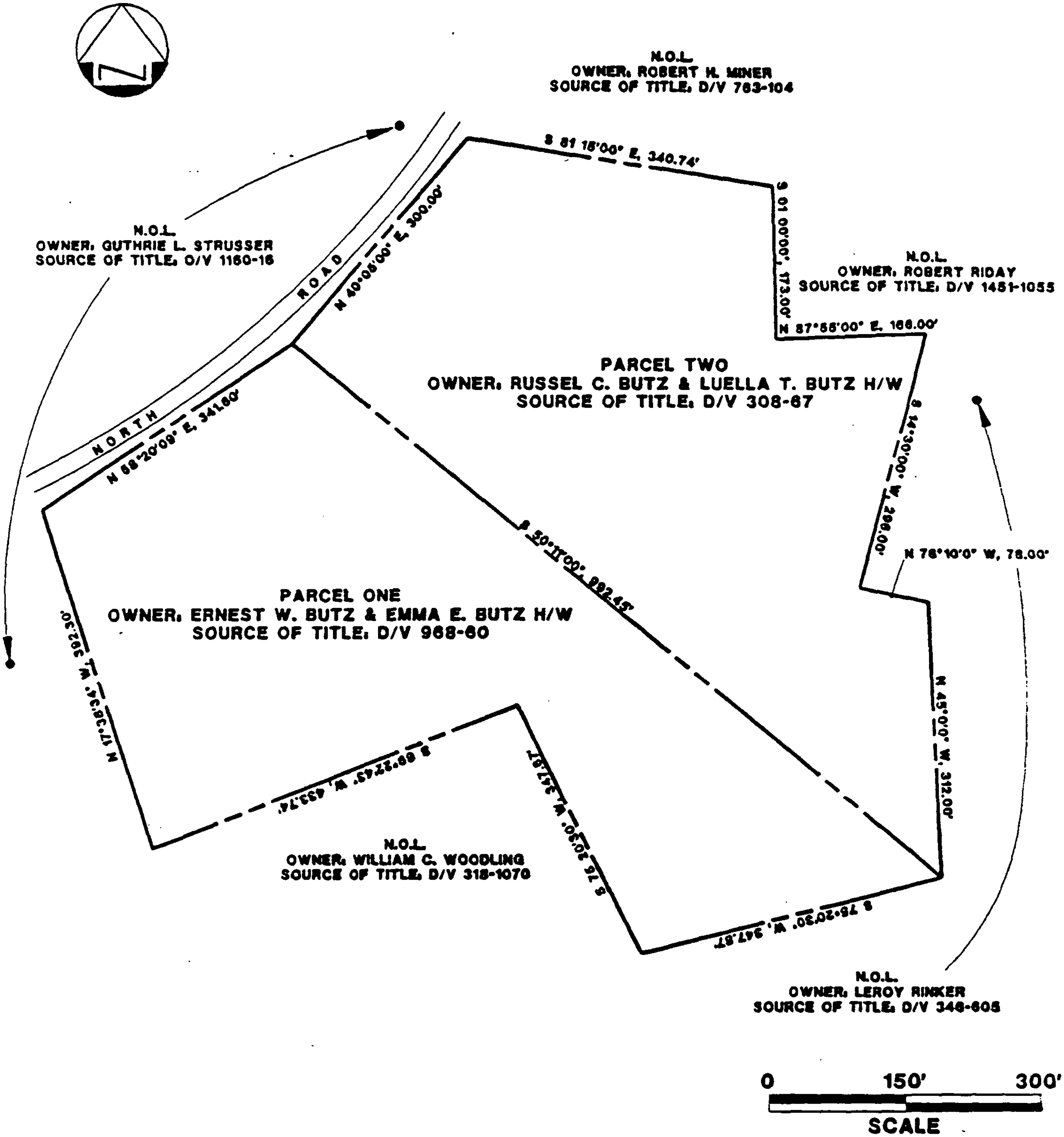
- TETRA TECH RESIDENTIAL WELL SAMPLE LOCATIONS
- • USEPA TAT RESIDENTIAL WELL LOCATIONS

NOTE: NUMBERS CORRESPOND TO NAMES OF RESIDENTS IN TABLE 1

0 2500' 5000'

SCALE

FIGURE 6
RESIDENTIAL WELL SAMPLE LOCATIONS
BUTZ LANDFILL



TETRA TECH, INC.

FIGURE 7
SITE PROPERTY LINES
BUTZ LANDFILL

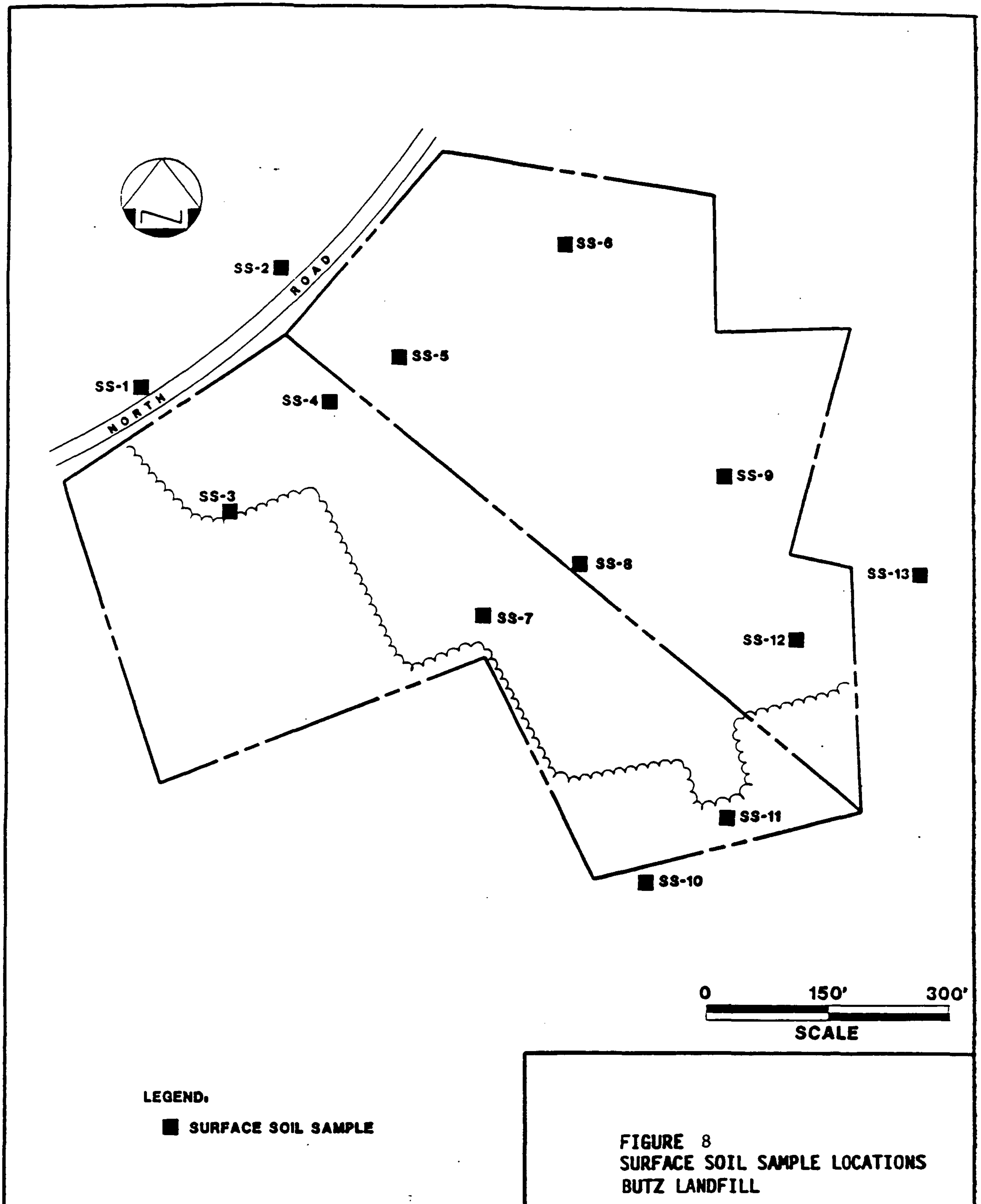
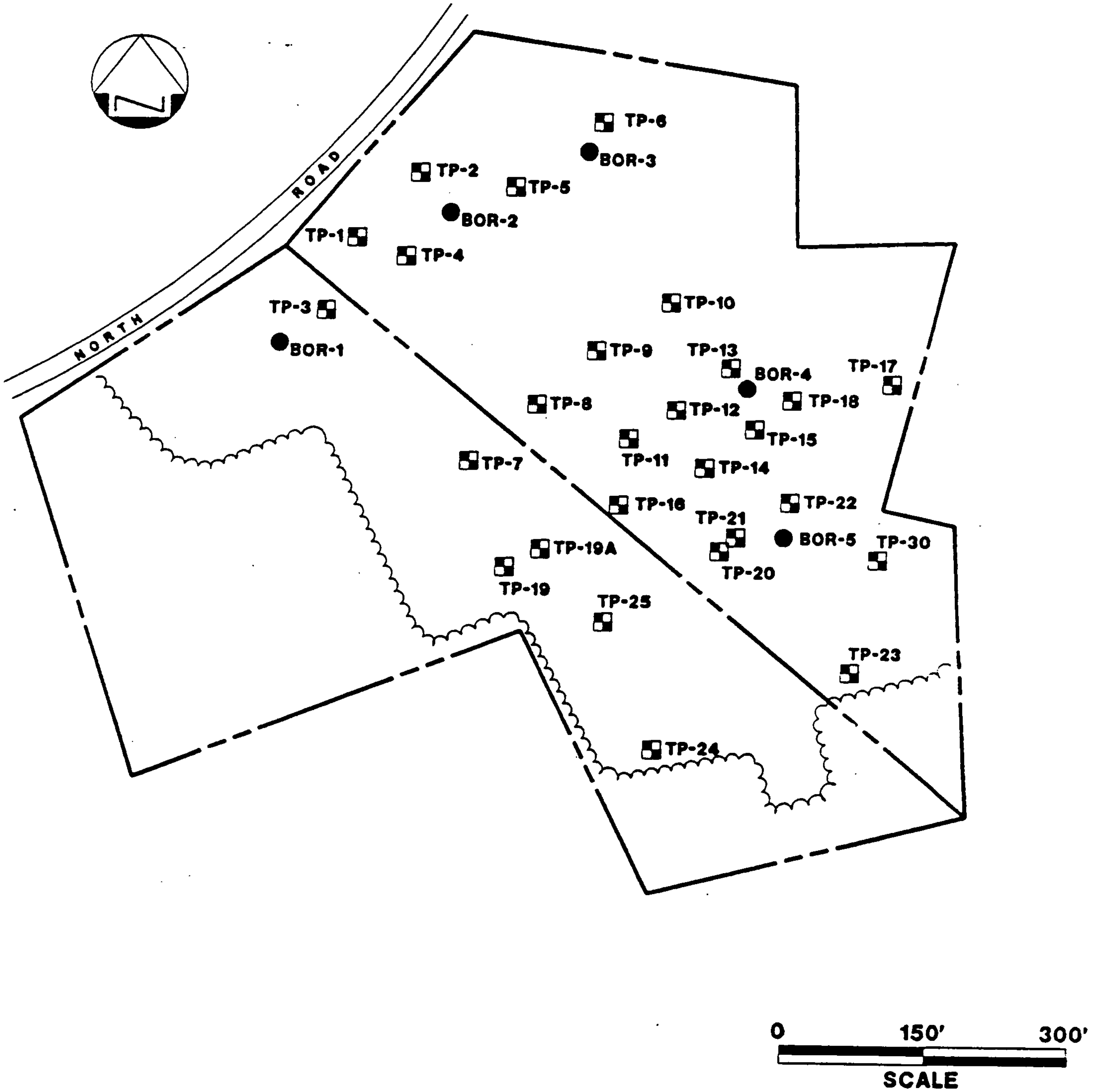


FIGURE 8
SURFACE SOIL SAMPLE LOCATIONS
BUTZ LANDFILL

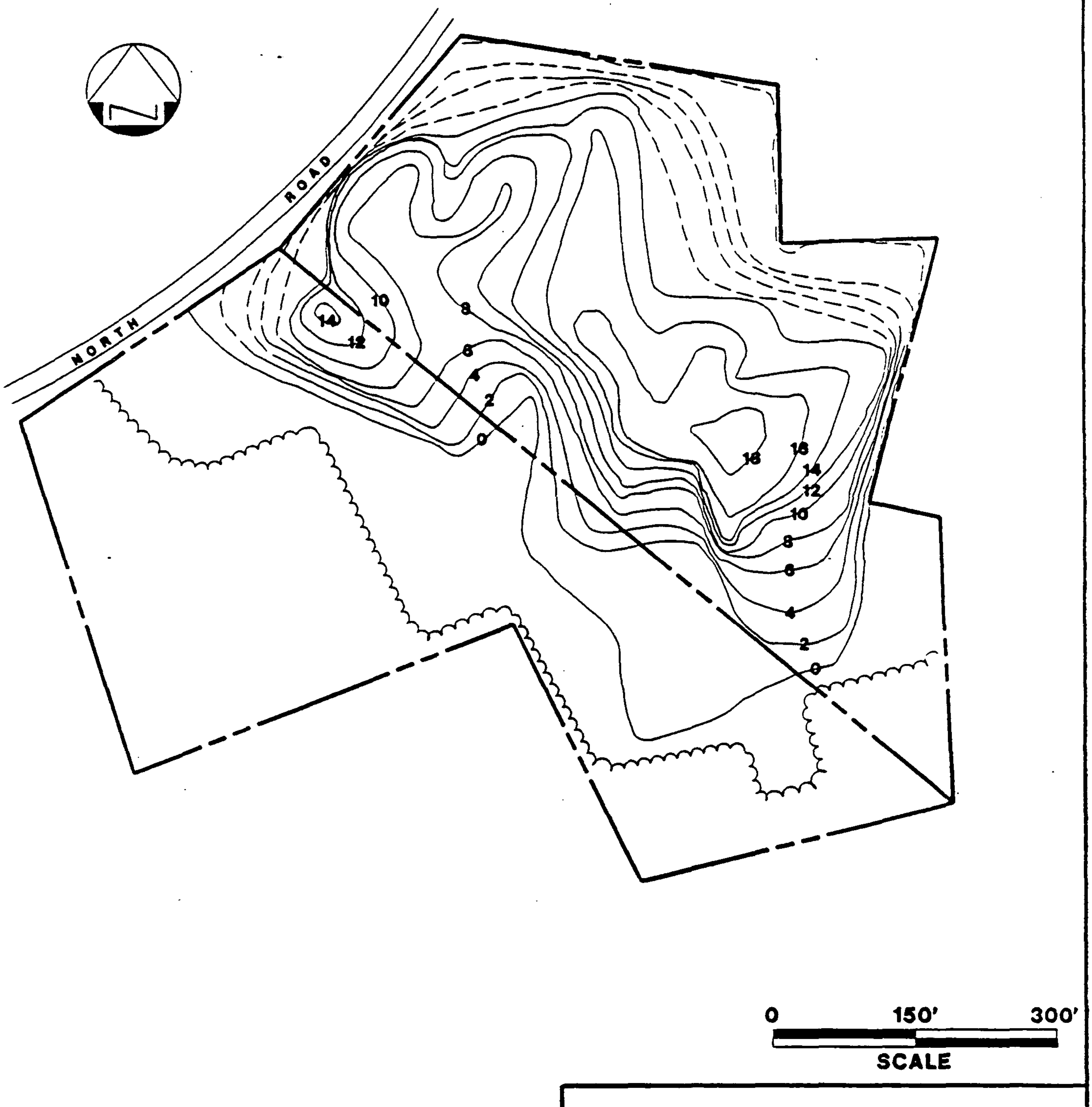


LEGEND:

- TEST PIT LOCATION
- SOIL BORING LOCATION

NOTE: THE LOCATION OF TEST PIT 31 WAS OBSCURED BY SNOWFALL BEFORE IT COULD BE SURVEYED. IT IS IN THE GENERAL VICINITY OF TP30. THERE ARE NO TEST PITS WITH DESIGNATIONS 26, 27, OR 29. TEST PIT 28 HAS BEEN DESIGNATED AS AN EQUIPMENT RINSEATE SAMPLE.

FIGURE 9
SUBSURFACE SOIL SAMPLE LOCATIONS
BUTZ LANDFILL



LEGEND:

— 15 — THICKNESS OF FILL MATERIAL (IN FEET)

NOTE: BASED ON 28 TEST PITS & 5 TEST BORINGS

FIGURE 10
THICKNESS OF FILL MATERIAL
BUTZ LANDFILL

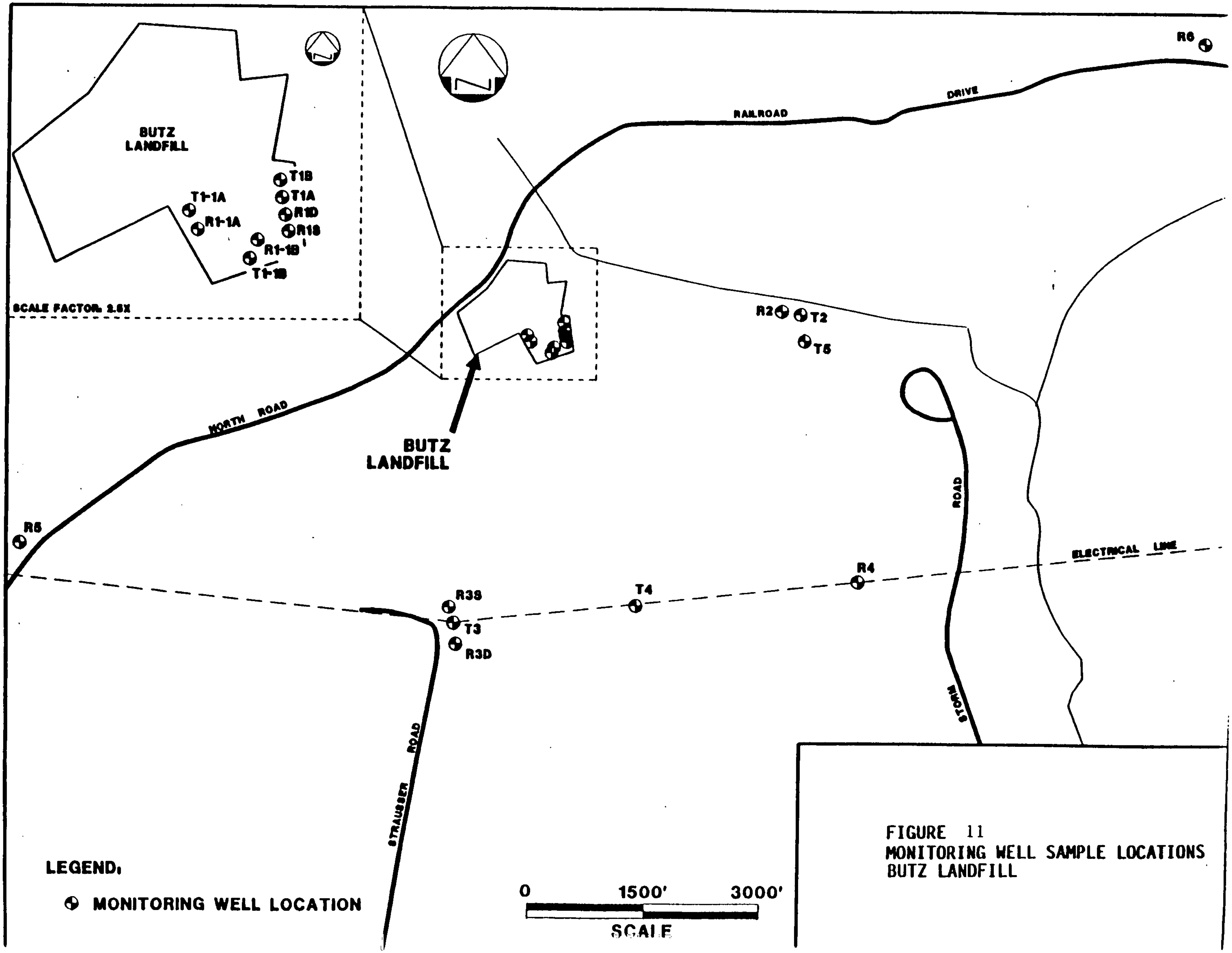


FIGURE 11
MONITORING WELL SAMPLE LOCATIONS
BUTZ LANDFILL

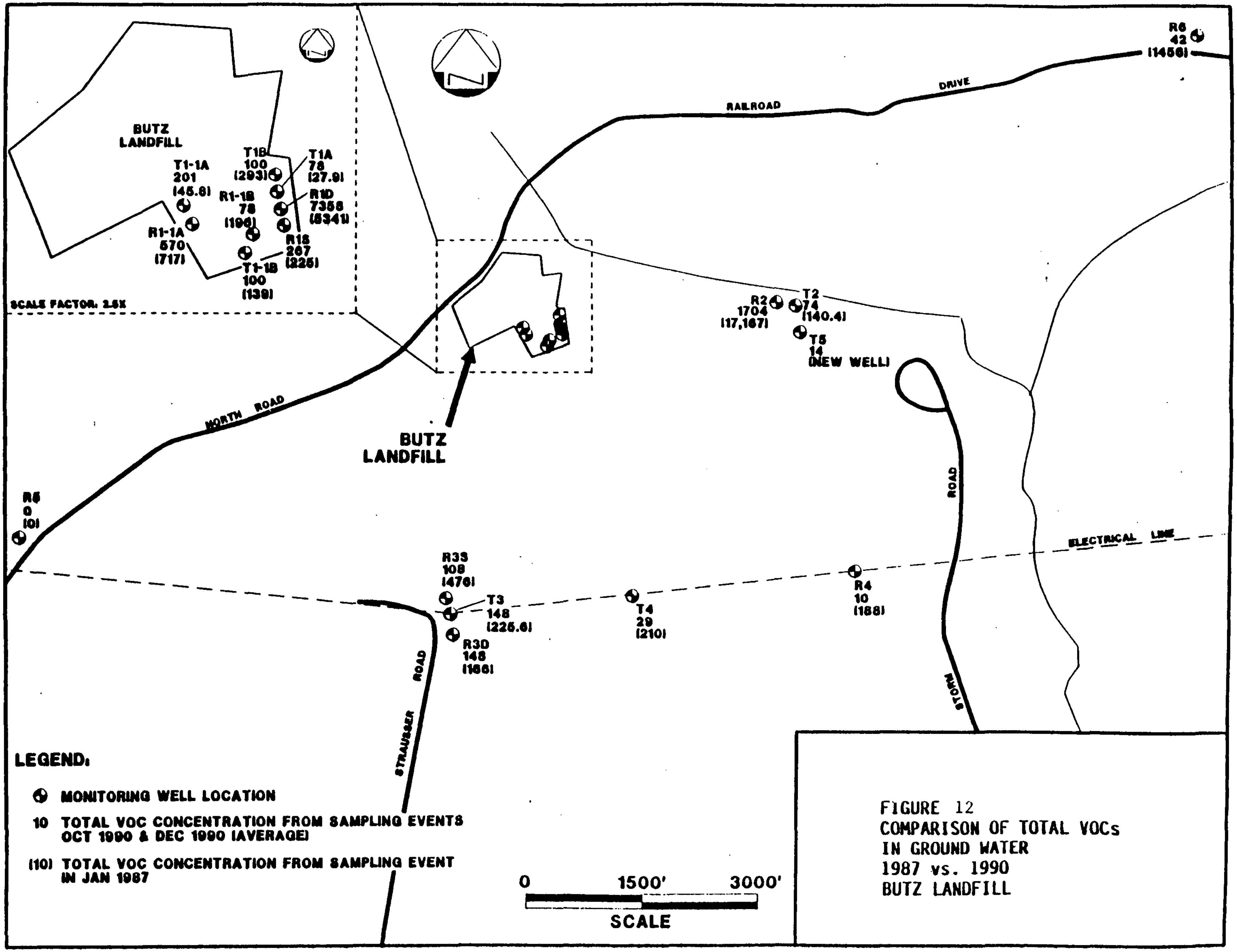
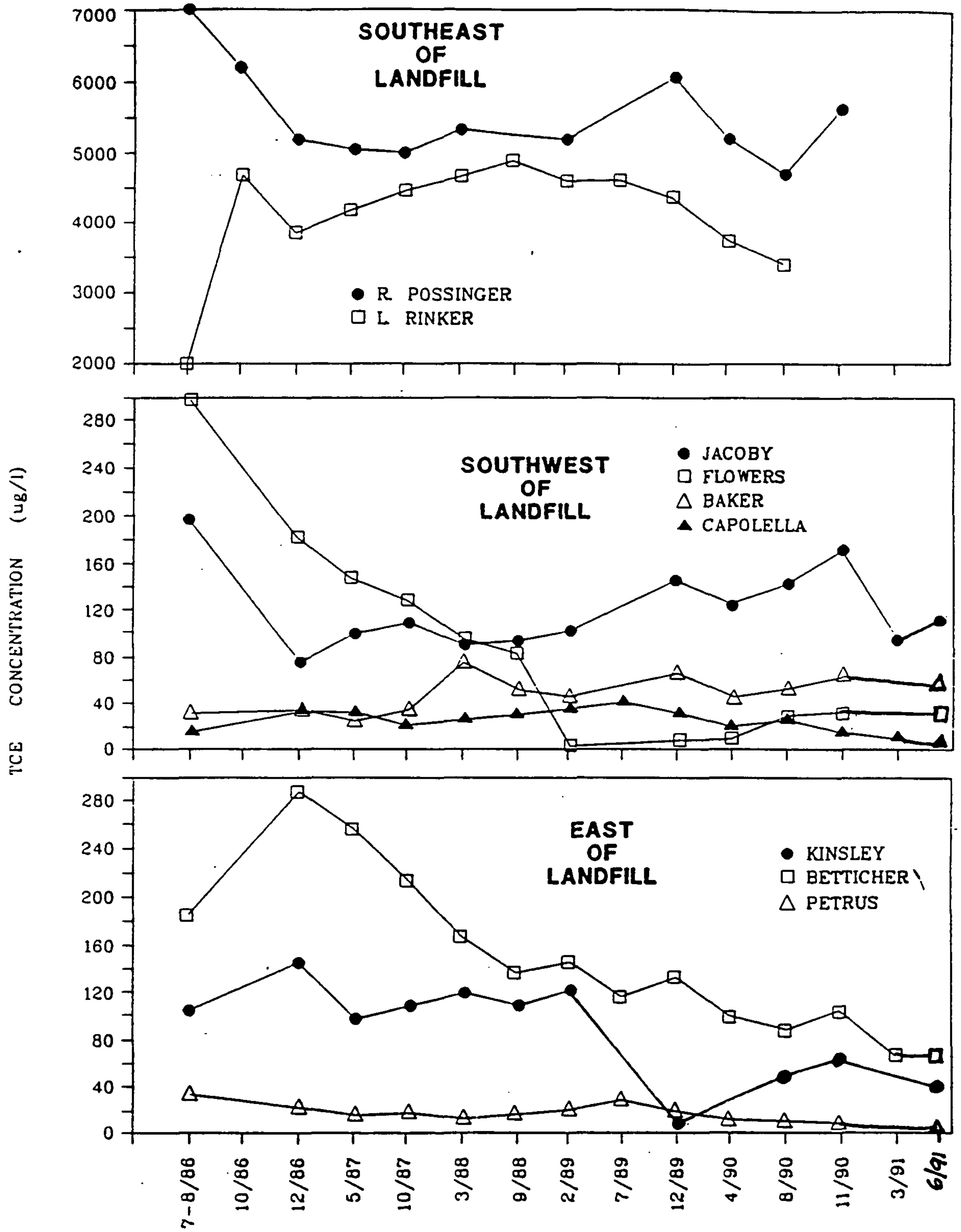
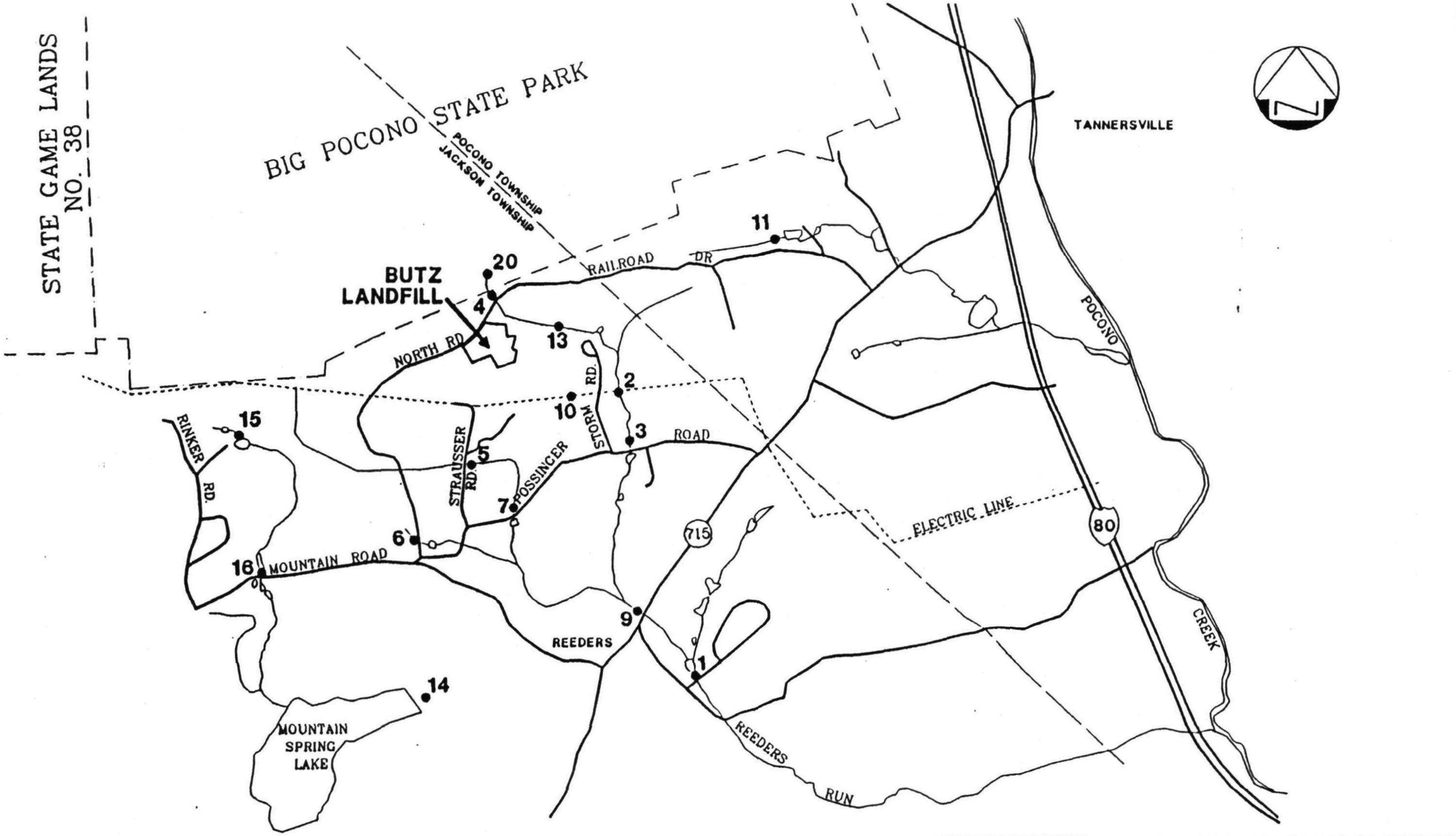


FIGURE 12
COMPARISON OF TOTAL VOCs
IN GROUND WATER
1987 vs. 1990
BUTZ LANDFILL



TETRA TECH, INC.

FIGURE 13
TCE CONCENTRATIONS IN RESIDENTIAL WELLS OVER TIME
BUTZ LANDFILL
7/86-3/91

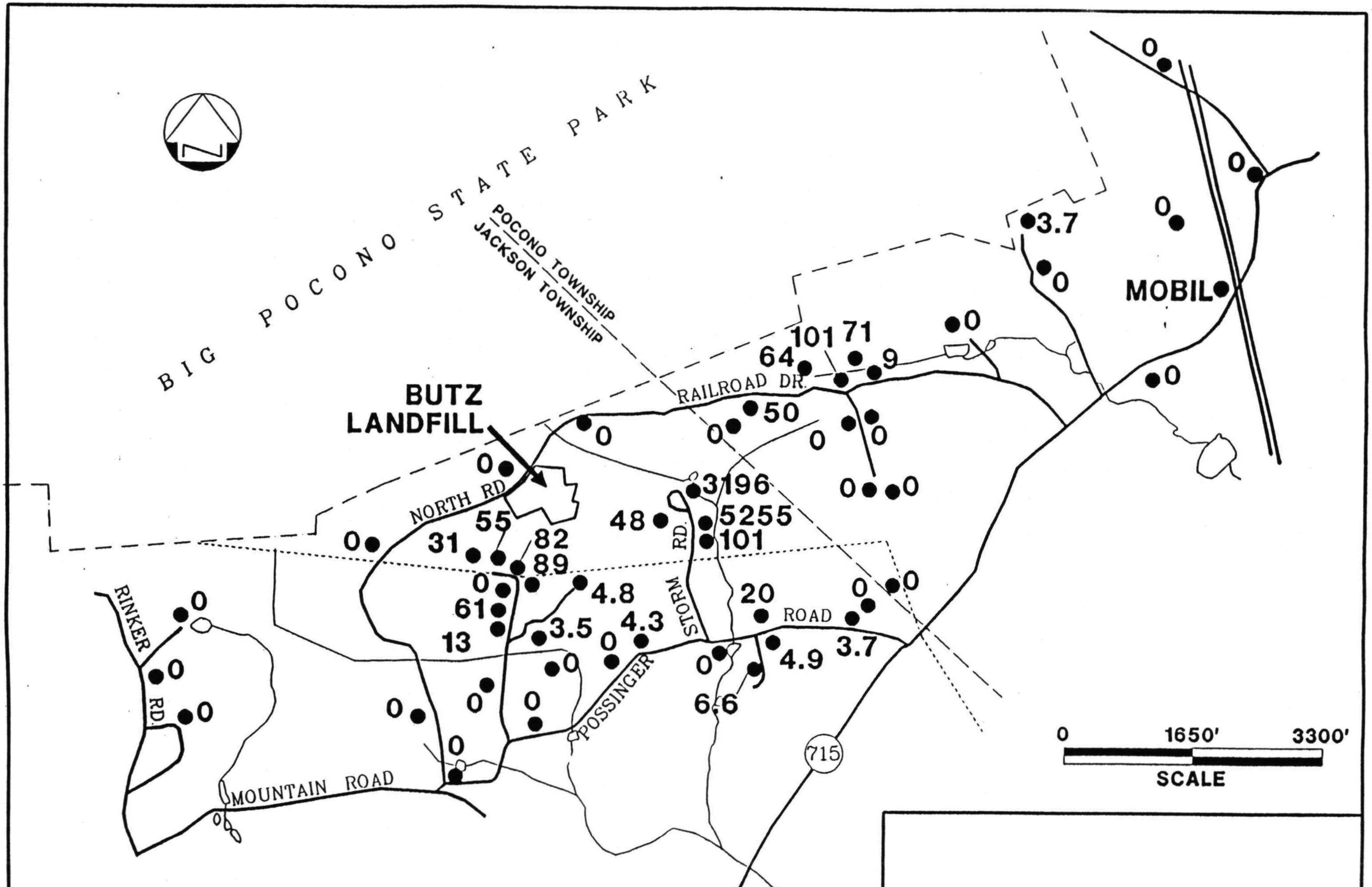


LEGEND:

•15 SURFACE WATER AND SEDIMENT SAMPLE LOCATION

0 2500' 5000'
SCALE

FIGURE 14
SURFACE WATER AND SEDIMENT
SAMPLING LOCATIONS
BUTZ LANDFILL



LEGEND:

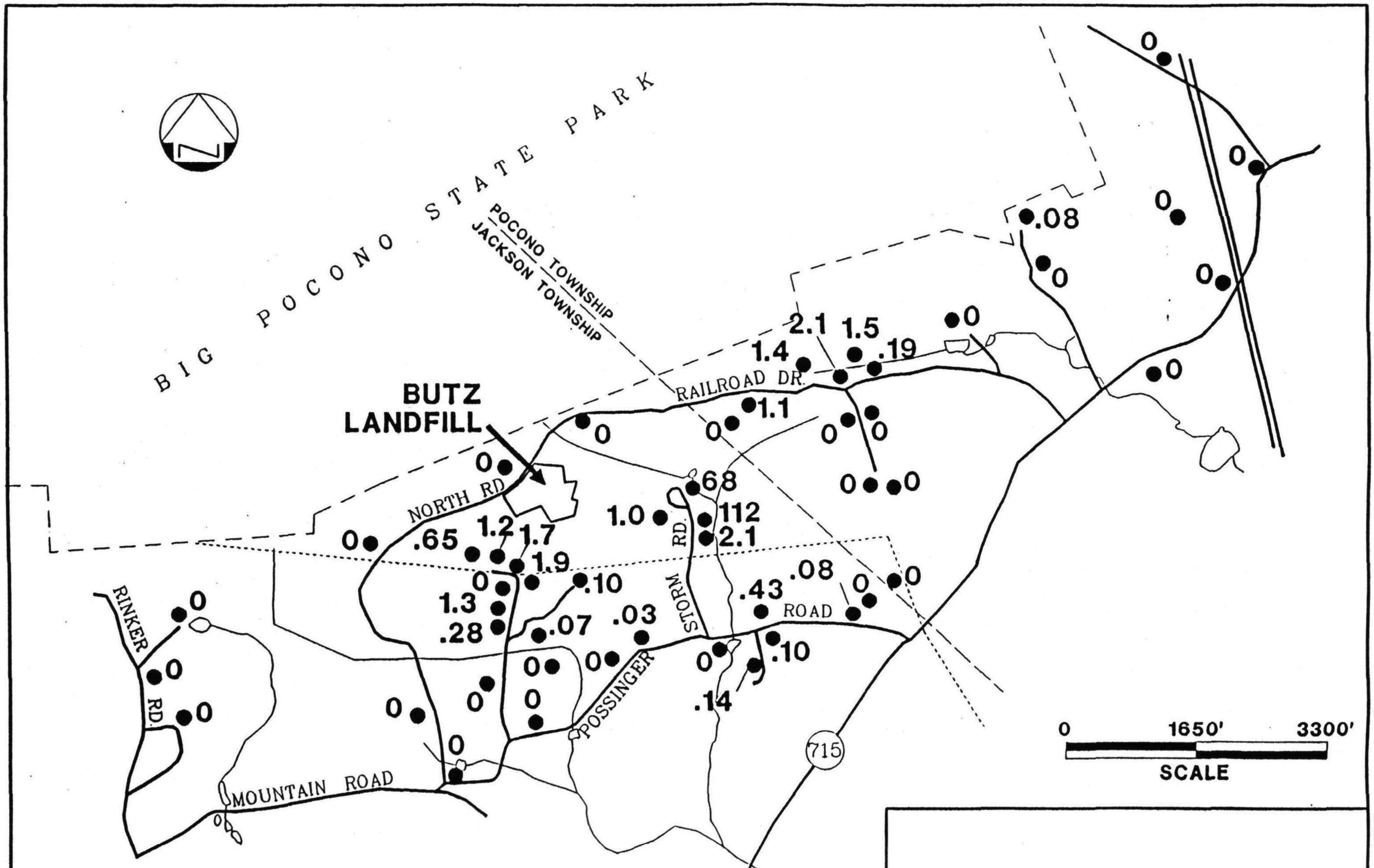
● RESIDENTIAL WELL SAMPLE LOCATIONS

ALL VALUES ARE 10^{-6}

VALUES CALCULATED FROM MOST RECENT SAMPLE RESULTS AVAILABLE FOR A GIVEN RESIDENCE

CRWELL DWG

FIGURE 15
CARCINOGENIC RISK ASSOCIATED
WITH USE OF UNTREATED
GROUND WATER
BUTZ LANDFILL



LEGEND:

● RESIDENTIAL WELL SAMPLE LOCATIONS

VALUES CALCULATED FROM MOST RECENT SAMPLE RESULTS AVAILABLE FOR A GIVEN RESIDENCE

NCRWELL DWG

FIGURE 16
NON-CARCINOGENIC HAZARD ASSOCIATED WITH USE OF UNTREATED GROUND WATER

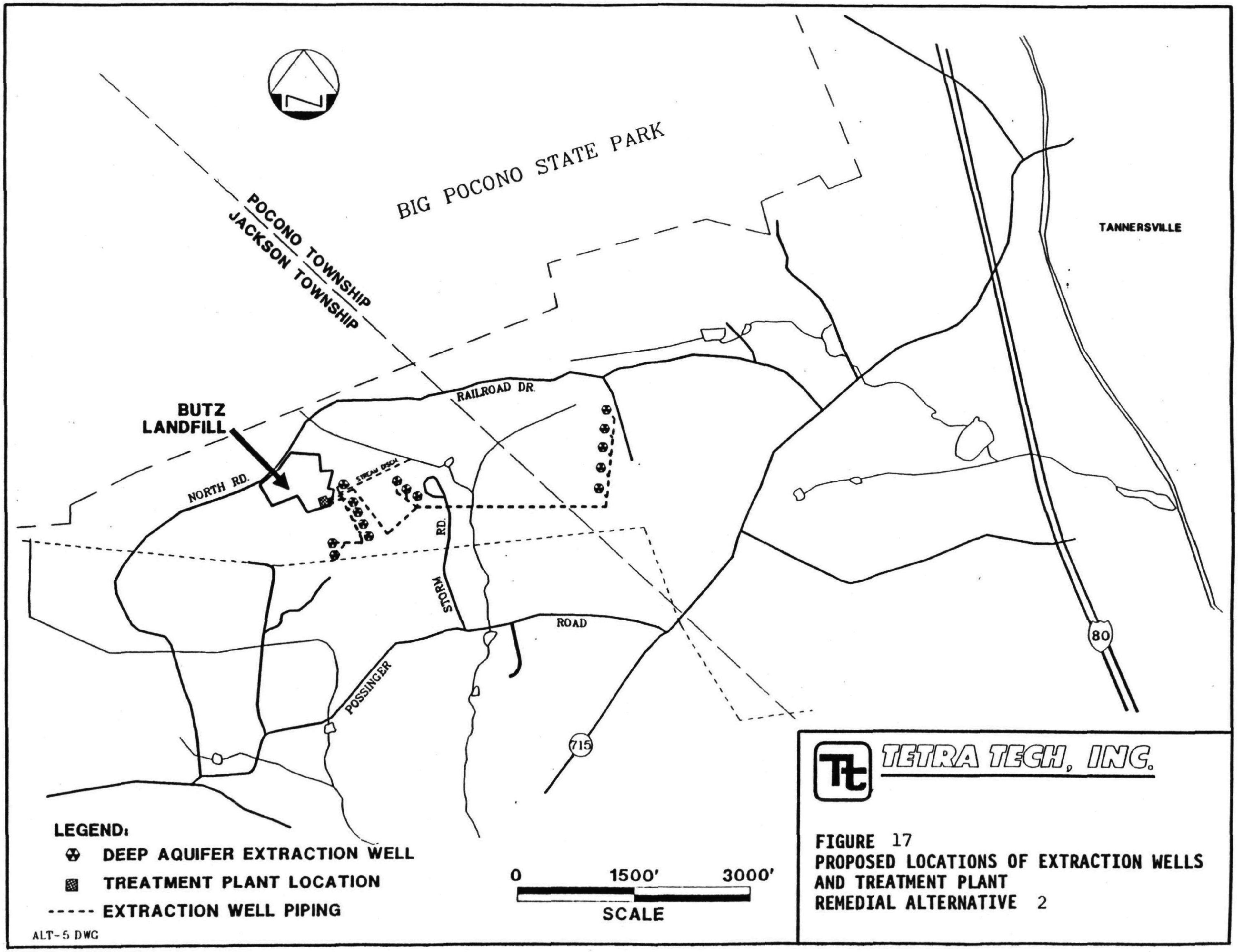


FIGURE 17
PROPOSED LOCATIONS OF EXTRACTION WELLS
AND TREATMENT PLANT
REMEDIAL ALTERNATIVE 2

TABLES

Table 1

Ground-Water Sampling Results
Residential Wells

Concentration of TCE (ug/l)*

	Resident	1986						1987				
		MAR (a)	JUL	AUG	OCT	NOV	DEC	JAN	FEB	MAY	JUN	OCT
1	P. Strausser	X	ND	X	X	X	X	X	1.5	ND	X	ND
2	Meckes	X	ND	X	X	X	X	X	X	X	X	
3	L. Rinker	X	2000	Z	4700	X	3900	X	X	4190	X	4480
4	R. Possinger	2600 (2860)	7000	Z	6200	X	5220	X	X	5090	X	5010
5	Bauer	27 (39)	23	X	Z	X	34.4	145	X	93.2	X	107
6	C. Streamside-dining	X	4.7	4.5	Z	Z	31.8	X	X	26.5	X	8.6
7	C. Streamside-chapel	X	4.5	X	X	X	ND	X	X	ND	X	5.2
8	Stillo	X	4	X	X	X	8.7	15	X	17.1	X	19.2
9	Wilgus	X	76	X	Z	X	18.2	X	X	19	X	19.3
10	Barthold	X	290	X	Z	X	20.6	X	X	22.9	X	28.2
11	Flowers	X	300	X	Z	X	183	X	X	149	X	132
12	Kinsley	X	89	X	Z	X	125	X	X	83.6	X	94.2
13	Oetrick/Mongilutz	X	2	X	X	X	7.9	8.8	X	11.1	X	8.8
14	N. Strausser	X	ND	X	X	X	X	X	ND	ND	X	X
15	F./K. Strausser	X	ND	X	X	X	X	X	ND	ND	X	ND
16	Baker (was Olshefski)	X	32	X	Z	X	36.7	X	X	24.6	X	34.2
17	Shoemaker	X	X	ND	X	X	X	X	X	X	X	X
18	Otteson	X	X	ND	X	X	ND	X	X	ND	X	ND
19	Adcock Farmhouse	X	X	640	Z	X	X	X	X	X	X	58.6
20	C. Dee Adcock	X	X	ND	X	X	X	X	X	X	X	X
21	Petrus	X	X	30	Z	X	21	X	X	12.8	X	16.6
22	N. Possinger	X	X	ND	X	X	ND	X	X	ND	X	ND
23	E. Possinger	X	X	ND	X	X	X	X	X	ND	X	X
24	Woodling	X	X	ND	X	X	ND	X	X	ND	X	ND
25	Cappolella	X	X	17	Z	X	35.5	X	X	29.6	X	24
26	Jacoby	X	X	200	Z	X	75.5	X	X	99	X	110
27	Betticher	X	X	160	Z	X	249	190	X	223	X	186
28	Riday	X	X	ND	X	X	X	X	X	ND	X	X
28a	O'Brien	X	X	X	X	X	X	X	X	X	ND	X
29	Mate	X	X	ND	X	X	ND	X	X	ND	X	ND
30	P. Strausser Jr.	X	X	5.4	Z-8.8	Z-2.0	13.2	X	X	X	X	14.4
31	Young	X	X	3.6	X	X	X	18.5	15	20.8	X	19.4
32	Palak	X	X	3.3	X	X	ND	X	X	ND	X	X
33	Tallada	X	X	ND	X	X	X	ND	X	ND	X	X
34	Mrs. Woodrow Adcock	X	X	ND	X	X	X	X	X	X	X	X
35	Bunnell	270 (411)	X	X	Z	X	23	X	X	49.6	X	43.5
36	M. Rinker	X	X	X	ND	X	X	X	X	X	X	X
37	Broderick	X	X	X	ND	X	X	X	X	X	X	X
38	Grinaway	X	X	X	ND	X	X	X	X	X	X	X
39	Schick (trailer)	X	X	X	ND	X	X	X	X	X	X	X
40	Munoz	X	X	X	ND	X	X	X	X	X	X	X
41	Farda/Smee	X	X	X	33.8	Z	11.6	X	X	9	X	6.3
42	Kelly (Miner)	ND	X	X	ND	X	X	X	X	X	X	X
43	Schick (house)	X	X	X	ND	X	X	X	X	X	X	X
44	Tony Farda	X	X	X	X	ND	X	X	X	ND	X	X
45	Summit Resort	X	X	X	X	Z	X	X	X	X	X	X
46	Fuel-Rite	X	X	X	X	216	X	X	X	75.4	X	X
47	Whitaker	X	X	X	X	15.6	18	X	X	16.4	X	17.6
48	Lane/Strausser	X	X	X	X	X	ND	X	X	X	X	X
49	Streamside (Mt. View)	ND	X	X	X	X	ND	X	X	ND	X	X
	Tallada	X	X	X	X	X	X	ND	X	X	X	X
	Starner	X	X	X	X	X	X	X	X	ND	X	X
	Bisbing	X	X	X	X	X	X	X	X	ND	X	X

* - Total volatile organic compound concentration in parentheses, if known.
(a) - Sampling performed by PADER. All other sampling performed by USEPA Technical Assistance Team (TAT).
ND - Not Detected
X - Ground-water not tested.
Z - Tested at tap only.

Table 1 (continued)

Ground-Water Sampling Results
Residential Wells

Concentration of TCE (ug/l)*

	RESIDENT	1988 MAR.	1988 SEPT.	1989 FEB.	1989 JUL.	1989 DEC.
1	P. Strausser	X	X	X	X	Z - ND
2	Meckes	X	X	X	X	X
3	L. Rinker	4670 (4686.0)	4910.0 (4931.6)	4610 (4622.2)	4620 (4633.3)	4410 (4435.4)
4	R. Possinger	5360 (5382.1)	X	5190 (5206.5)	X	6090 (6181.1)
5	Bauer	X	X	X	X	X
6	C. Streamside-dining	10.3 (10.3)	8.8 (8.8)	10.1 (10.1)	Z - ND	9.4 (9.4)
7	C. Streamside-chapel	X	X	X	X	X
8	Stillo	17.1 (17.1)	18.0 (18.0)	13.1 (13.1)	X	7.3 (7.3)
9	Wilgus	15.4 (15.4)	23.0 (26.0)	28.3 (28.3)	X	43.3 (51.7)
10	Barthold	26.0 (26.0)	80.1 (85.1)	72.0 (77.8)	X	97.3 (114.5
11	Flowers	94.6 (99.0)	83.3 (87.1)	4.0 (4.0)	X	7.6 (7.6)
12	Kinsley	105.0 (112.0)	94.6 (101.4)	107 (111.0)	X	X
13	Detrick/Mongilutz	10.5/4.8	7.3/3.6	6.3/4.0	8.0/3.1	11.3/4.0
14	M. Strausser	ND	Z - ND	Z - ND	Z - ND	Z - ND
15	F./K. Strausser	X	Z - ND	X	X	X
16	Baker (was Olshefski)	75.6 (80.8)	50.9 (55.5)	46.3 (54.7)	X	65.8 (73.5)
17	Shoemaker	X	X	X	X	X
18	Otteson	X	X	X	X	X
19	Adcock Farmhouse	X	X	53.6 (58.71)	X	X
20	C. Dee Adcock	X	X	X	X	X
21	Petrus	12.9 (12.9)	17.4 (17.4)	19.3 (19.3)	26.8 (26.8)	19.6 (19.6)
22	N. Possinger	X	Z - ND	X	X	X
23	E. Possinger	X	X	X	X	X
24	Woodling	Z - 1.6	Z - ND	X	Z - ND	Z - ND
25	Cappolella	26.9 (28.9)	31.1 (31.1)	36.0 (40.6)	41.3 (45.1)	31.0 (31.0)
	Farleigh	17.1 (17.1)	72.3 (24.1)	X	18.2 (18.2)	14.1 (14.1)
	Kirkpatrick	X	X	48.7 (54.2)	1X	43.6 (45.2)
26	Jacoby	91.3 (95.7)	92.0 (98.6)	101 (113.2)	X	150 (170.1)
27	Betticher	145.0 (147.4)	119.0 (122.5)	127 (133.2)	101 (103.9)	116 (122.4)
28	Riday	X	X	X	X	X
28a	O'Brien	X	X	X	X	X
29	Mate	X	Z - ND	Z - ND	Z - ND	Z - ND
30	P. Strausser Jr.	9.8 (9.8)	7.0 (7.0)	5.6 (5.6)	6.1 (6.1)	X
31	Young	13.0 (13.0)	6.8 (6.8)	4.2 (4.2)	X	3.9 (3.9)
32	Pelak	X	X	X	X	X
33	Tallada	X	X	X	X	X
34	Mrs. Woodrow Adcock	X	X	X	X	X
35	Bunnell	38.6 (40.0)	X	69.3 (76.5)	52.7 (55.1)	47.3 (52.1)
36	M. Rinker	X	X	X	X	X
37	Broderick	X	X	X	X	X
38	Grinaway	X	X	X	X	X
39	Schick (trailer)	X	X	X	X	X
40	Munoz	X	X	X	X	X
41	Farda/Smee	8.5 (8.5)	2.9 (2.9)	3.8 (3.8)	4.6 (4.6)	X
42	Kelly (Miner)	X	X	X	X	X
43	Schick (house)	X	X	X	X	X
44	Tony Farda	X	Z - ND	X	X	3.2 (3.2)
45	Summit Resort	X	X	X	X	X
46	Fuel-Rite	X	X	X	X	X
47	Whitaker	21.3 (22.7)	X	X	X	X
48	Lane/Strausser	X	X	X	X	X
49	Streamside (Mt. View)	X	X	X	X	X
	Tallada	X	X	X	X	X
	Haney	X	X	X	64.3 (64.3)	X
	Cobles	X	24.3 (24.3)	18.1 (18.1)	15.1 (15.1)	11.9 (11.9)
	Sullivan	X	X	X	X	10.6 (10.6)

* - Total volatile organic compound concentration in parentheses, if known.
(a) - Sampling performed by PADER. All other sampling performed by USEPA Technical Assistance Team (TAT).
ND - Not Detected
X - Ground-water not tested.
Z - Tested at tap only.-

Table 1 (continued)

Ground-Water Sampling Results
Residential Wells

Concentration of TCE (ug/l)*

	RESIDENT	1990 APRIL	1990 AUGUST	1990 NOVEMBER	1991 MARCH
1	P. Strausser	X	X	X	ND-Z
2	Meckes	X	X	X	X
3	L. Rinker	3670 (3689.1)	3400 (3419.9)	X	X
4	R. Possinger	5110 (5141.3)	4810 (4837.1)	5590 (5632.5)	X
5	Bauer	X	X	X	X
6	C. Streamside-dining	6.8	5.1	7.0	X
7	C. Streamside-chapel	X	X	X	X
8	Stillo	3.7	4.0	3.4	4.6
9	Wilgus	35.7 (41.4)	44.1 (46.2)	58.7 (63.1)	ND-Z
10	Barthold	108 (122)	120 (126.8)	104 (112.7)	87 (94.2)
11	Flowers	17.2	23.0	32.6 (34)	X
12	Kinsley	X	X	X	X
13	Detrick/Mongilutz	10.8	6.9/2.1	9.3/1.6	3.9/5.4
14	M. Strausser	ND-Z	ND-Z	ND-Z	ND-Z
15	F./K. Strausser	X	X	X	X
16	Baker (was Olshefski)	42 (48.7)	52.6 (58.9)	64.7 (73.0)	X
17	Shoemaker	X	X	X	X
18	Otteson	X	X	X	X
19	Adcock Farmhouse	X	X	X	X
20	C. Dee Adcock	X	X	X	X
21	Petrus	14.0	11.4	9.6	X
22	M. Possinger	X	X	ND-Z	X
23	E. Possinger	X	X	X	X
24	Woodling	X	ND-Z	ND-Z	X
25	Cappolella	19.9	24.6	18.4	14.0
	Farleigh	13.6	16.7	13.6	X
	Kirkpatrick	51.9 (56)	X	X	X
26	Jacoby	122 (135.8)	143 (152.8)	173 (182.4)	94.7 (102.5)
27	Betticher	99.1 (101.2	86.2 (89.1)	104 (129.4)	68.3 (72.6)
28	Riday	X	X	X	X
28a	O'Brien	X	X	X	X
29	Mate	X	ND-Z	ND-Z	ND-Z
30	P. Strausser Jr.	3.6	2.2	3.7	X
31	Young	4.4	5.1	ND	X
32	Pelak	X	X	X	X
33	Tallada	X	ND-Z	ND-Z	X
34	Mrs. Woodrow Adcock	X	X	X	X
35	Bunnell	38.3	34.9	42.6 (45.4)	50.7 (55.6)
36	M. Rinker	X	X	X	X
37	Broderick	X	X	X	X
38	Gringway	X	X	X	X
39	Schick (trailer)	X	X	X	X
40	Munoz	X	X	X	X
41	Farda/Smee	X	3.9	X	X
42	Kelly (Miner)	X	X	X	X
43	Schick (house)	X	X	X	X
44	Tony Farda	2.6	X	X	X
45	Summit Resort	X	X	X	X
46	Fuel-Rite	X	X	X	X
47	Whitaker	X	X	X	X
48	Lane/Strausser	X	X	X	X
49	Streamside (Mt. View)	X	X	X	X
	Tallada	X	ND-Z	X	ND-Z
	Haney	X	X	X	X
	Cobles	X	X	X	X
	Sullivan	X	46.0 (47.6)	59.4 (63)	

* - Total volatile organic compound concentration in parentheses, if known.
(a) - Sampling performed by PADER. All other sampling performed by USEPA Technical Assistance Team (TAT).
ND - Not Detected
X - Ground-water not tested.
Z - Tested at tap only.

TABLE 2

GROUND WATER SAMPLING RESULTS
EERU INSTALLED WELLS

Concentration of Volatile Organics (ug/l)
JANUARY 1987

WELL	TRICHLORO-ETHYLENE	trans-1,2-dichloroethene	vinyl chloride	benzene	ethyl benzene	tetra-chloroethene	toluene	carbon tetrachloride	chloro-form	1,1-dichloro-ethene	methylene chloride	chloro-benzene
T1A		9.7	11.0									7.2
T1B	236.0	37.4	13.7	J-4.1	J-1.3							
T1.1A	40.0	5.8										
T1.1B	118.0	20.8										
T2	17.8	67.5	39.7	J-2.4								13.0
T3	196.0	26.4		J-1.0			J-2.2					
T4	156.0	42.5				J-1.5	J-2.1				7.6	
R1S *	138.0	41.3	12.2	J-3.8								29.0
R1D	4800.0	267.0	J-1.4			J-3.2			J-1.6			
R1.1A	680.0	33.7					J-1.1					J-1.4
R1.1B	166.0	27.7					J-1.4					
R2	15700.0	7.5	68.7	40.3		10.4		J-2.0	J-4.9	7.5	J-1.9	J-1.3
R3S	437.0	33.1					5.9					
R3D	156.0	7.6					J-1.7					
R4	165.0	22.5										
R5	J-2.9											
R6	1270.0	186.0										

J- positive response below limit of quantification; considered approximate

* - This well was sampled for all Priority Pollutants.
No pesticides, PCB's, cyanide or phenols were detected.
Some base neutral compounds gave positive responses but were below the limit of quantification.

Table 3

Surface Soil Samples

Butz Landfill

Sample Location	CLP #	Organic Compounds Detected	Concentration (ug/kg)
SS-01	CED64	none	
SS-02	CED65	[v] acetone [sv] fluorathene [sv] pyrene	140 180 150
SS-03	CED66	none	
SS-04	CED67	none	
SS-14 (dup. of SS-04)	CED68	[v] acetone	16(J)
SS-05	CED69	none	
SS-06	CED70	none	
SS-07	CED71	[PCB] aroclor 1260 [sv] bis(2-ethylhexyl) phthalate	270 (J) 110
SS-08	CED72	[sv] butlybenzylphthalate [sv] bis(2-ethylhexyl) phthalate	170 120
SS-09	CED73	none	
SS-10	CED74	none	
SS-11	CED75	none	
SS-12	CED76	none	
SS-13	CED77	none	
SS-16 (equip. rinseate blank)	CED79	none	
TB-04	CED86		

v - volatiles
sv - semi-volatiles
PCB - polychlorinated biophenyls

Table 4

Test Pit Soil Samples
December 3-7, 1990

Butz Landfill

Sample Location	CLP #	Organic Compounds Detected[1]	Concentration[2] (ug/kg)
TP-01 (10')	CEX01	none	
TP-02 (7-8')	CEX02	none	
TP-04 (8')	CEX04	[v] ethylbenzene [v] total xylenes	4 7
TP-05 (8.5')	CEX06	none	
TP-19A (6')	CEX08	none	
TP-07 (3')	CEX09	none	
TP-08 (4')	CEX10	none	
TP-10 (13')	CEX12	[v] styrene [p] aldrin [sv] Total	5 13(J) (12) 2,020 - all (J)
TP-16 (7')	CEX18	[sv] Total	(12) 5,297 - no (J)
TP-17 (14')	CEX19	[v] ethylbenzene [v] total xylenes [sv] Total	3 3 (1) 480 - (J)
TP-18 (18')	CEX20	[v] ethylbenzene [v] total xylenes [sv] Total	7 21 (1) 440 - (J)
TP-29 (dup of TP-18)	CEX21	[v] ethylbenzene [v] total xylenes [v] chlorobenzene [sv] Total	12 31 2 (11) 2,470 - all (J)
TP-19 (6')	CEX22	[v] ethylbenzene [v] total xylenes [v] chlorobenzene [v] 1,2-dichloroethene [v] benzene [v] tetrachloroethane [v] toluene [PCB] aroclor 1254 [p] total pesticides [sv] Total	90(J) 2,000 22,000 16 23 22 8,800 2,800(J) 1,173(J) (10) 490,600 - all (J)
TP-20 (6')	CEX23	none	
TP-22 (18')	CEX26	[v] ethylbenzene [v] total xylenes [v] chlorobenzene [sv] Total	28 90 15 (1) 2,149
TP-23 (4')	CEX27	none	
TP-24 (8')	CEX28	[v] ethylbenzene [v] total xylenes [v] chlorobenzene [v] acetone [v] toluene [sv] Total	3 17 110 190 26 (5) 969
TP-25 (6')	CEX29	[sv] Total	(1) 120
TP-28 (equip. rinseate blank)	CED78	none	
TB-01 (trip blank)	CEX24		

[1] v - volatiles p - pesticide
sv - semi-volatiles PCB - polychlorinated biphenols

[2] (12) = number of compounds detected; 2,020 = total concentration

Table 5

Subsurface Soil Samples
December 3-7, 1990

Butz Landfill

Sample Location	CLP #	Organic Compounds Detected	Concentration (ug/kg)
BOR-01 (10-12')	CED80	[v] trichloroethene	23
BOR-02 (13-15')	CED81	none	
BOR-03 (13.5-15.5')	CED82	[sv] phenol	630
		[sv] 4-methylphenol	310
		[sv] naphthalene	580
		[sv] phenanthrene	610
		[sv] anthracene	160
		[sv] di-n-butylphthalate	110
		[sv] fluoranthene	260
		[sv] pyrene	300
		[sv] benzo(a) anthracene	150
		[sv] chrysene	130
		[sv] bis(2-ethylhexyl) phthalate	180
		[sv] benzo(a) pyrene	96
		[sv] 2-methylnaphthalene	900
		[sv] fluorene	88
		[sv] n-nitrosodiphenylamine	150
		[sv] Total	4654
BOR-05 (10.5-12.5')	CED85	none	
BOR-08 (equip. rinseate blank)	CED87	[v] TCE	5

v - volatiles
sv - semi-volatiles

Table 6

Ground-Water Samples
Round 1
October 29-November 2, 1990

Butz Landfill

Station Location	CLP #	ORGANIC COMPOUNDS DETECTED (ug/l)					
		Vinyl Chloride	1,2-Dichloroethene	TCE	Benzene	Other Volatiles	Total Semi-Volatiles
T1.1A-01	CET56	--	81	260	--		
T1.1B-01	CET57	--	--	9	--	total xylenes @ 5(J) 1,1-dichloroethene @ 3(J) toluene @ 4(J)	
T1A-01	CET54	6(J)	160	360	--	chlorobenzene @ 12	1 @ 130(J)
T1B-01	CET55	4(J)	25	13	3(J)	1,1 dichloroethene @ 2(J) toluene @ 3(J) chlorobenzene @ 12	1 @ 13(J)
T2-01	CET58	9(J)	40	8	2(J)	chloroethane @ 5(J) chlorobenzene @ 8	
T3-01	CET59	--	15	120	--		
T4-01	CET60	--	4(J)	21	--		
R1S-01	CET61	4(J)	120	260	--	chlorobenzene @ 7(J)	
R7-01 (Dup of R1S)	CET71	4(J)	110	240	--	chlorobenzene @ 7(J)	
R8-01 (Field Matrix Blank)	CET72	--	--	--	--		
R9-01 (Equip. Rinseate Blank)	CET73	--	--	--	--		
R1D-01	CET62	7(J)	720(J)	8400(J)	4(J)	tetracholoroethene @ 6(J) 1,1-dichloroethene @ 3(J) carbon tetrachloride @ 1(J) chlorobenzene @ 1(J)	
R1.1A-01	CET63	4(J)	35	520	--		
R1.1B-01	CET64	--	11	67	--		
R2-01	CET65	--	950	770	--	carbon disulfide @ 2(J) 1,1 dichloroethene @ 2(J)	1 @ 4(J)
R3S-01	CET66	--	8	60	--	toluene @ 3(J)	1 @ 15
R3D-01	CET67	--	8	130	--		
R4-01	CET68	--	3(J)	14	--	carbon disulfide @ 2(J)	
R5-01	CET69	--	--	--	--		1 @ 4(J)
R6-01	CET70	--	24	59	--		

Table 7

Ground-Water Samples
Round 2
December 3-7, 1990

BUTZ LANDFILL

Station Location	CLP #	ORGANIC COMPOUNDS DETECTED (ug/l)					
		Vinyl Chloride	1,2-Dichloroethene	TCE	Benzene	Other Volatiles	Total Semi-Volatiles
T1.1A-02	CED38	--	--	61	--		
T1.1B-02	CED63	--	29	150	--		
T1A-02	CEX30	--	31	53	2(J)	chlorobenzene @ 2	1 @ 130(J)
T1B-02	CEX31	--	--	--	--		
T2-02	CEX32	13	45	3(J)	1(J)	chloroethane @ 2(J) chlorobenzene @ 11	
T3-02	CEX33	--	20	140	--		
T4-02	CEX34	--	4(J)	29	--		
R1S-02	CEX35	3(J)	39	83	1(J)	chlorobenzene @ 16	
R7-02 (Dup of R1S)	CEX36	3(J)	36	78	1(J)	chlorobenzene @ 16	
R8-02 (Field Matrix Blank)	CEX37	--	--	--	--		
R9-02 (Equip. Rinseate Blank)	CEX38	--	--	--	--		
R1D-02	CEX39	3(J)	360	5200	2(J)	1,1-dichloroethene @ 1(J) 1,12-trichloroethane @ 4(J) tetrachloroethene @ 4(J)	
R1.1A-02	CEX41	--	51	530	--		
R2-02	CEX42	3(J)	730	950	--		
R3S-02	CEX43	--	15	130	--		
R3D-02	CEX44	--	8	150	--		
R4-02	CEX45	--	2(J)	--	--		
R5-02	CEX46	--	--	--	--		
R6-02	CEX47	--	--	--	--		
T5-02	CEX56	--	14	--	--		
TB-02 (Trip Blank)	CEX07	--	--	--	--		
TB-02 (Trip Blank)	CEX05	--	--	--	--		

TABLE 8

EPA-INSTALLED MONITOR WELLS

TCE CONCENTRATIONS
ug/1

Well #	1/87	11/90	12/90
T1A	--*	360	53
T1B	236	13	--
T1.1A	40	260	61
T1.1B	118	9	150
T2	18	8	3
T3	196	120	140
T4	156	21	29
R1S	138	260	83
R1D	5050	8400 (J)	5200
R1.1A	680	520	530
R1.1B	116	67	not sampled
R2	15700	770	950
R3S	437	60	130
R3D	156	130	150
R4	165	14	--
R5	3 (J)	--	--
R6	1270	59	--
T5 #	N/A	N/A	--

* -- designates that the sample contained no TCE above analytical dection limits.

Well T5 was installed during RI/FS activities. Only one sample was obtained from this well.

Table 9

Pump Test Sampling (μg/l)

Butz Landfill

Sample	Date/Time	Organic Compounds Detected	Concentration	Comments
R2-PT	12/11/90 1415	vinyl chloride 1,1-dichloroethene 1,1-dichloroethane 1,2-dichloroethene trichloroethene 1,1,2-trichloroethane benzene tetrachloroethane	34 6 3 1,200 110,000 12 17 8	influent to air stripper 15 minutes into pump test
PT-02	12/12/90 0930	1,2-dichloroethene trichloroethene	3(J) 7	influent to air stripper 19½ hours into pump test
PT-EFF	12/12/90 0945	1,2-dichloroethene trichloroethene	3(J) 7	treated effluent
TB-08 (trip blank)		none		

Table 10

Surface Water Samples
December 10-11, 1990

Butz Landfill

Sample Location	CLP #	Organic Compounds Detected	Concentration (ug/l)
SW-01	CED25	[v] TCE	2(J)
SW-02	CED29	[v] TCE	10
SW-03	CED28	[v] TCE	3(J)
SW-17 (dup. of SW-03)	CED34	[v] TCE	1(J)
SW-04*	CED27	[v] TCE/none	32(J)/none
SW-05	CED30	none	
SW-06	CED31	none	
SW-07	CED32	none	
SW-09	CED35	none	
SW-10	CED36	[v] TCE	1(J)
SW-11	CED37	none	
SW-13	CED40	[v] vinyl chloride [v] 1,2-dichloroethene [v] TCE [v] chlorobenzene	2(J) 10 1(J) 2(J)
SW-14	CED41	[sv] benzoic acid [sv] di-n-butylphthalate [p] delta BHC [p] gamma BHC	25(J) 5(J) 0.16 0.08
SW-15	CED42	none	
SW-16	CED43	none	
SW-18 (field matrix blank)	CED44		
SW-19 (equip. rinseate blank)	CED26	[v] chloroform	4(J)
SW-20**		none	

v - volatiles P - pesticide
sv - semi-volatiles

Note: Quantitation units are compound and sample specific. See Appendix C for complete list of data.

* SW-04 collected upgradient of landfill. Initial results from 12/90 thought to be anomalous. Confirmatory sampling performed in 6/91 indicated no volatile organic compounds were present.

** SW-20 collected approximately 20 yards upstream of SW-04 in June, 1991.

Table 11
Conclusions for the Butz Landfill
Baseline Risk Assessment

Exposure Pathway	Potential Carcinogenic Risk	Potential Noncarcinogenic Risk (Hazard Index)(HI)	Comments
Current Land-Use Conditions			
Use of Untreated groundwater from 62 Residential Wells (a)	No carcinogens detected in 31 wells. Risk range for remaining 31 wells: 2E-6 - 6E-3 *	0.10 - 105	When evaluating ingestion, dermal absorption and inhalation of VOCs while showering using untreated groundwater, the potential carcinogenic risk for all 31 of the residential wells exceeds the NCP point of departure (i.e., 10^{-6}). Risks exceed the upper-bound of the NCP acceptable risk range (i.e., 10^{-4}) only for Baker, Barthold, Jacoby, F. Possinger, L. Rinker, Kinsley, Betticher and Adcock Farmhouse residences due to TCE and 1,1-DCE. HI exceeds unity (1) for 10 of the residences due to TCE; F. Possinger (HI=105) and L. Rinker (HI=74) representing the two highest residences. Therefore, noncarcinogenic effects may occur from use of untreated groundwater from these wells. Treatment systems are installed at contaminated wells to prevent exposure.
Children Playing in Surface Soil at Butz Landfill	6E-7	<1(6E-3)	Potential carcinogenic risk below NCP point of departure (10^{-6}). HI below unity (1); therefore, noncarcinogenic risks unlikely to occur.
Children Playing in Streams and Groundwater Seeps.			
Groundwater Seeps Near Butz Landfill			Potential carcinogenic risks associated with direct contact with sediments certain locations slightly exceeded NCP point of departure (i.e., 10^{-6}), yet were well within the acceptable risk range (i.e., $<10^{-4}$). Risks due to PAHs and heavy metals, which may not be related to site disposal activities. HIs for all locations were below unity (1) (with the exceptions of stations 2, 13, and 14); therefore, noncarcinogenic effects unlikely to occur.
Station 10	2E-6	<1(4E-2)	
Station 13	6E-5	1	
West Fork of Reeders Run			
Station 5	no contaminants	selected	
Station 6	2E-6	<1(1E-2)	
Station 7	no contaminants	selected	
Mountain Spring Lake			
Station 14	5E-5	1	
North Fork of Reeders Run			
Station 2	1E-5	1	
Station 3	9E-8	<1(8E-3)	
Station 9	8E-6	<1(0.2)	
Station 1	9E-8	<1(2E-2)	
Wetland East of Landfill			
Station 11	--	<1(9E-3)	

* This notation means 2 x 10^{-6} to 6 x 10^{-3} ,or, 2 in 1,000,000 to 6 in 1,000

Table 11 (Cont.)
Conclusions for the Butz Landfill
Baseline Risk Assessment

Exposure Pathway	Potential Carcinogenic Risk	Potential Noncarcinogenic Risk (Hazard Index)(HI)	Comments
<u>Current Land-Use Conditions</u>			
Ingestion of Fish in Streams by Recreational Fishermen			Potential carcinogenic risks are below the NCP point of departure (i.e., 10^{-6}). HI exceeds unity (1) for several stream locations due to mercury. Mercury levels ranged from 0.25 to 1 ug/L which is below the drinking water MCL (2 ug/L), but exceeds the AWQC for ingestion of fish (0.15 ug/L). Mercury, however, was not detected in groundwater, surface soil, or subsurface soil at Butz Landfill. In fact, mercury levels increased in the North Fork further away from the site. Therefore, mercury may not be present due to site related activities.
<u>West Fork of Reeders Run</u>			
Station 5	No contaminants	selected	
Station 6	--	8.4	
Station 7	No contaminants	selected	
<u>North Fork of Reeders Run</u>			
Station 2	6E-7	1.0	
Station 3	2E-7	2.1	
Station 9	--	2.1	
Station 1	2E-7	8.4	
<u>Future Land-Use Conditions</u>			
Use of Groundwater at Butz landfill by Hypothetical Residents (a)	9E-3	183	Potential carcinogenic risks exceed upper-bound of NCP acceptable risk range (i.e., 10^{-4}) due to TCE. HI exceeded unity (1); therefore, noncarcinogenic effects may occur from use of groundwater. Harzard quotients for 1,2-DCE and TCE exceeded unity. Similar levels of TCE in on-site monitoring wells were found in off-site residential wells. R1D had the highest detected concentration of TCE (6,800 ug/L). TCE was detected in all bedrock monitoring wells.

(a) Risk estimates include ingestion, dermal absorption and inhalation (showering) exposures.

HI - Hazard Index
TCE - Trichloroethene
1,2-DCE - 1,2-Dichloroethene
1,1-DCE - 1,1-Dichloroethene

TABLE 12
ALTERNATIVE 2, OPTION 1
CONTAMINATED GROUND WATER EXTRACTION, TREATMENT BY AIR STRIPPING AND DISCHARGE

ITEM	DIRECT CAPITAL	ANNUAL O&M
Bedrock Aquifer Extraction Well System		
Direct Capital		
clearing & grubbing (3.0 acre for access & pipes)	20,000	
tree removal (1.5 acre)	10,000	
piping to treatment plant (6,400 LF @ $20/LF)	128,000	
6" ϕ well installation, = 150 feet deep (15 wells @ $15,000 ea.)	225,000	
decontamination; disposal of cuttings & water (15 @ $6,000 ea.)	90,000	
electrical power (15 @ $3,000 ea.)	45,000	
electrical equipment, controls, 15 gpm pumps, pit-less adaptor, low water shut-off, etc. (15 @ $7,000 ea.)	105,000	

	$ 623,000	
Annual O&M		
power (15 @ $2,000 ea.)		30,000
equipment replacement		15,000

		$ 45,000
Site Work/Road to Treatment Plant		
Direct Capital		
1,500 LF @ $50/LF	$ 75,000	
Chemical Precipitation System - 225 gpm		
Direct Capital	$ 1,000,000	
Annual O&M		
equipment replacement and sludge disposal		$ 60,000

TABLE 12, CONTINUED

ITEM	DIRECT CAPITAL	ANNUAL O&M
Air Stripping Towers and Vapor Phase Carbon - 225 gpm		
Direct Capital - based on 25 mg/ℓ VOC influent		
System: two towers ea. 4' φ 26 ft. tall towers, two vapor phase carbon units, dual heaters, two blower, two pumps, 5,000 gallon flow equalization tank, control panel, and installation	450,000	
clearing & grubbing (0.5 acre)	5,000	
tree removal (0.5 acre)	3,000	
building	150,000	
electrical power supply from North Road	40,000	
	$ 648,000	
Annual O&M		
equipment replacement, power, and carbon regeneration or disposal		$ 260,000
Stream Discharge		
Direct Capital		
clearing & grubbing (0.25 acre for access & pipes)	3,000	
tree removal (0.25 acre)	2,000	
pipe (500 LF @ $80/LF)	$ 40,000	
	$ 45,000	
Annual O&M		
stream monitoring ($4,000/month)		$ 48,000
laboratory coordination, data validation, data evaluation, and report preparation		36,000
		$ 84,000
Start Up	$ 40,000	
Sub Total	$ 2,431,000	
Direct Capital Contingency (10%)	243,000	
Total Direct Capital Costs	$ 2,674,000	
Total Annual O&M Costs		$ 449,000

TABLE 12, CONTINUED

ITEM	DIRECT CAPITAL	ANNUAL O&M
SUMMARY		
Total Direct Capital Costs	$ 2,674,000	
Total Annual O&M Costs		$ 449,000
Remedial Action & Remedial Design Consulting Services (40%)	1,070,000	
Legal & Administrative (25%)	669,000	
Contingency (25%)	669,000	112,000
Total Capital	**$ 5,082,000**	
Total Annual O&M		**$ 561,000**
Present Worth of Annual O&M (8 ¾ % for 30 years)	**$ 5,930,000**	
TOTAL PRESENT WORTH COST	**$ 11,012,000**	

TABLE 13
ALTERNATIVE 2, OPTION 2
CONTAMINATED GROUND WATER EXTRACTION, TREATMENT BY CARBON ADSORPTION, AND DISCHARGE

ITEM	DIRECT CAPITAL	ANNUAL O&M
Bedrock Aquifer Extraction Well System		
Direct Capital		
clearing & grubbing (3.0 acre for access & pipes)	20,000	
tree removal (1.5 acre)	10,000	
piping to treatment plant (6,400 LF @ $20/LF)	128,000	
6" ϕ well installation, ≈ 150 feet deep (15 wells @ $15,000 ea.)	225,000	
decontamination; disposal of cuttings & water (15 @ $6,000 ea.)	90,000	
electrical power (15 @ $3,000 ea.)	45,000	
electrical equipment, controls, 15 gpm pumps, pit-less adaptor, low water shut-off, etc. (15 @ $7,000 ea.)	105,000	

	$ 623,000	
Annual O&M		
power (15 @ $2,000 ea.)		30,000
equipment replacement		15,000

		$ 45,000
Site Work/Road to Treatment Plant		
Direct Capital		
1,500 LF @ $50/LF	$ 75,000	
Chemical Precipitation System - 225 gpm		
Direct Capital	$ 1,000,000	
Annual O&M		
equipment replacement and sludge disposal		$ 60,000

TABLE 13, CONTINUED

ITEM	DIRECT CAPITAL	ANNUAL O&M
Granular Activated Carbon (GAC) - 225 gpm		
Direct Capital - based on 25 mg/ℓ influent		
System: four skids, equalization tank, control panel, transfer pump, two GAC units in series and two in parallel, installation	600,000	
clearing & grubbing (0.5 acre)	5,000	
tree removal (0.5 acre)	3,000	
building	150,000	
electrical power supply from North Road	40,000	

	$ 798,000	
Annual O&M		
power, equipment replacement, and carbon regeneration/replacement		$ 500,000
Stream Discharge		
Direct Capital		
clearing & grubbing (0.25 acre for access & pipes)	3,000	
tree removal (0.25 acre)	2,000	
pipe (500 LF @ $80/LF)	$ 40,000	

	$ 45,000	
Annual O&M		
stream monitoring ($4,000/month)		$ 48,000
laboratory coordination, data validation, data evaluation, and report preparation		36,000

		$ 84,000
Start Up	$ 40,000	
Sub Total	$ 2,581,000	
Direct Capital Contingency (10%)	258,000	
Total Direct Capital Costs	$ 2,839,000	
Total Annual O&M Costs		$ 689,000

TABLE 13, CONTINUED

ITEM	DIRECT CAPITAL	ANNUAL O&M
SUMMARY		
Total Direct Capital Costs	$ 2,839,000	
Total Annual O&M Costs		$ 689,000
Remedial Action & Remedial Design Consulting Services (40%)	1,136,000	
Legal & Administrative (25%)	710,000	
Contingency (25%)	710,000	172,000
Total Capital	**$ 5,395,000**	
Total Annual O&M		**$ 861,000**
Present Worth of Annual O&M (8 ½ % for 30 years)	**$ 9,100,000**	
TOTAL PRESENT WORTH COST	**$ 14,495,000**	